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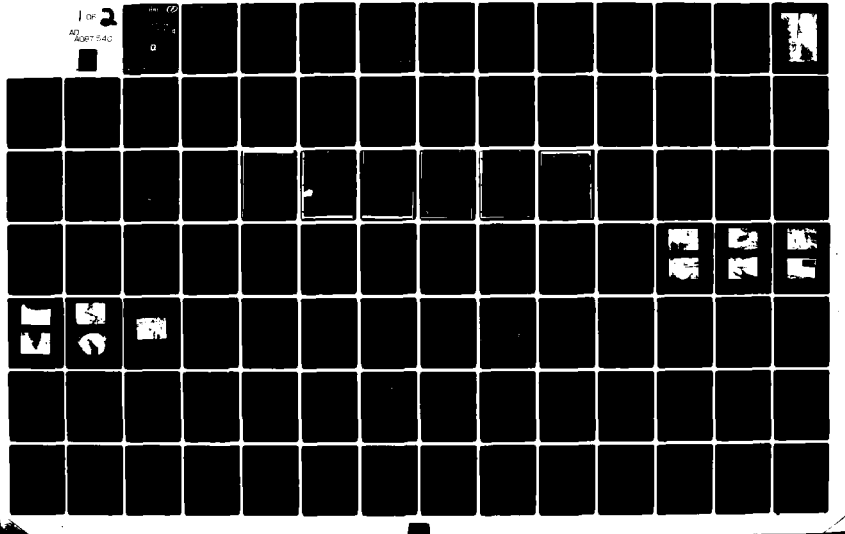

LEVEL II

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PASSAIC RIVER BASIN
FOXS BROOK, MORRIS COUNTY
NEW JERSEY

FOXS LAKE DAM
NJ 00342

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PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

80 8 4 085

JANUARY 1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

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Dams
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National Dam Safety Program
Foxs Lake Dam, New Jersey
Erosion
Riprap

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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(6) National Dam Safety Program. Foxs Lake Dam (NJ00342), Passaic River Basin, Foxs Brook, Morris County, New Jersey. Phase I Inspection Report.

(9) Final rept.,

(10) Warren A. Guinan

(11) Jan 80

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DEPARTMENT OF THE ARMY
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CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-N

29 JUL 1980

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Foxs Lake Dam in Morris County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Foxs Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to six percent of the Spillway Design Flood--SDF - would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood.) To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report, engineering studies and analyses should be performed to:

(1) Design or specify and oversee repairs for the erosion that has occurred on the upstream slope and on the west abutment.

(2) Design or specify and oversee the installation of riprap or other erosion protection on the upstream face of the dam.

(3) Design or specify and oversee the establishment of grassy vegetation for erosion protection on the crest of the embankment.

(4) Design or specify and oversee repairs to the eroded, spalled and cracked concrete on the ogee spillway, spillway walls and downstream concrete retaining walls.

(5) Specify and oversee procedures for removing trees from the upstream slope of the dam.

(6) Investigate the cause of the unevenness of the crest and design and implement remedial measures if necessary.

c. Within thirty days from the date of approval of this report, the following remedial actions should be initiated:

(1) Start a program of periodically checking the condition of the dam.

(2) Control trespassing on the dam to reduce erosion.

d. The following remedial actions should be initiated within six months from the date of approval of this report.

(1) Clear trees and brush from either side of the downstream channel for a distance of at least 50 feet downstream of the dam or to the nearest property line, whichever is closer to the dam.

(2) Establish a surveillance program for use during and after periods of heavy rainfall and also a warning program to follow in case of emergency conditions.

(3) Expose and clean out valve boxes to the outlet pipes.

(4) Remove the debris at the downstream toe of the spillway.

e. The following remedial actions should be initiated within one year from the date of the report:

(1) The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

(2) The outlet valves should be exercised periodically to ensure proper operation and flush any sediment that has collected in the pipes.

NAPEN-N
Honorable Brendan T. Byrne

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Courter of the Thirteenth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

FOXS LAKE DAM (NJ00342)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 9 November 1979 by Anderson-Nichols & Co., Inc. under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Foxs Lake Dam, initially listed as a high hazard potential structure, but reduced to a significant hazard potential structure as a result of this inspection, is judged to be in fair overall condition. The dam's spillway is considered inadequate because a flow equivalent to six percent of the Spillway Design Flood--SDF - would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood.) To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

b. Within six months from the date of approval of this report, engineering studies and analyses should be performed to:

(1) Design or specify and oversee repairs for the erosion that has occurred on the upstream slope and on the west abutment.

(2) Design or specify and oversee the installation of riprap or other erosion protection on the upstream face of the dam.

(3) Design or specify and oversee the establishment of grassy vegetation for erosion protection on the crest of the embankment.

(4) Design or specify and oversee repairs to the eroded, spalled and cracked concrete on the ogee spillway, spillway walls and downstream concrete retaining walls.

(5) Specify and oversee procedures for removing trees from the upstream slope of the dam.

(6) Investigate the cause of the unevenness of the crest and design and implement remedial measures if necessary.

c. Within thirty days from the date of approval of this report, the following remedial actions should be initiated:

(1) Start a program of periodically checking the condition of the dam.

(2) Control trespassing on the dam to reduce erosion.

d. The following remedial actions should be initiated within six months from the date of approval of this report.

(1) Clear trees and brush from either side of the downstream channel for a distance of at least 50 feet downstream of the dam or to the nearest property line, whichever is closer to the dam.

(2) Establish a surveillance program for use during and after periods of heavy rainfall and also a warning program to follow in case of emergency conditions.

(3) Expose and clean out valve boxes to the outlet pipes.

(4) Remove the debris at the downstream toe of the spillway.

e. The following remedial actions should be initiated within one year from the date of the report:

(1) The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam.

(2) The outlet valves should be exercised periodically to ensure proper operation and flush any sediment that has collected in the pipes.

APPROVED: James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 6 JUN 80

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Foxs Lake Dam
Identification No.:	FED ID No. NJ00342
State Located:	New Jersey
County Located:	Morris
Stream:	Foxs Brook
River Basin:	Passaic
Date of Inspection:	November 9, 1979

ASSESSMENT OF GENERAL CONDITIONS

Foxs Lake Dam (commonly known as Park Lakes Dam) is about 55 years old and in fair overall condition. It is small in size and is classified as Significant Hazard. Erosion of the upstream face of the dam embankment has occurred at the west side of the principal spillway structure, leaving the short training wall there undermined and largely non-functional. Some erosion has occurred along the upstream face of the dam embankment east of the principal spillway. There are a few trees growing on the upstream face of the embankment. The concrete principal spillway structure itself is in good overall condition. Some cracking of the concrete was observed and spalling of concrete is generally limited to portions of the structure close to the normal water line. The crest of the dam has a generally uneven surface and is practically void of vegetation. The twin outlet pipes that protrude from the downstream face of the principal spillway structure are in good condition, exhibiting only minor surface rust. The spillway is capable of passing less than 5% of the half-PMF and is inadequate.

We recommend that the owner retain the services of a professional engineer, qualified in the design and inspection of dams, to accomplish the following in the near future: specify and oversee repairs for the erosion that has occurred on the upstream face and at the west spillway abutment; design or specify and oversee the establishment of grassy vegetation for erosion protection of the crest of the embankment; design or specify and oversee repairs to the eroded, spalled and cracked concrete on the ogee spillway, spillway walls, and downstream concrete retaining walls; specify and oversee procedures for removing trees and their root systems from the upstream slope of the dam; further evaluate the hydrology and hydraulics of the watershed, reservoir, dam, and spillway, and design and implement necessary mitigating measures; and investigate the cause of the unevenness of the crest and design and implement remedial measures if necessary.

We further recommend that as a part of operating and maintenance procedures, the owner check the condition of the dam periodically and control trespassing on the dam to reduce erosion. This should commence immediately. In the near future, the owner should: clear brush and trees from either side of the downstream channel for a distance of at least 50 feet downstream of the dam, or the the nearest property line, whichever is closer to the dam; establish a surveillance program for use during and after periods of heavy rainfall, and also a warning program to follow in case of emergency conditions; exercise the outlet valves periodically to insure proper operation

and flush any sediment that has collected in the pipes; expose and clean out valve boxes to the outlet pipes; remove the debris at the downstream toe of the spillway. Within one year from the date of approval of this report, the owner should develop written operating procedures and a periodic maintenance plan to insure the safety of the dam.

ANDERSON-NICHOLS & CO., INC.

Warren A. Guinan

Warren A. Guinan
Project Manager
New Jersey No. 16848

9 NOV 1979

OVERVIEW

FOXS LAKE DAM

CONTENTS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY REPORT
FOXS LAKE DAM N.J. NO. 25-49 FED ID NO. NJ00342

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION PROGRAM
FOXS LAKE DAM
U.S. #NJ00342-N.J. #25-49

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Authority to perform the Phase I Safety Inspection of Foxs Lake Dam (commonly known as Park Lakes Dam) was received from the State of New Jersey, Department of Environmental Protection, Division of Water Resources by letter dated 26 October, 1979 under Contract No. FPM-39 dated 28 June 1978. This Authority was given pursuant to the National Dam Inspection Act, Public Law 92-367 and by agreement between the State and the U.S. Army Engineers District, Philadelphia. The inspection discussed herein was performed by Anderson-Nichols & Company, Inc. on 9 November 1979.

b. Purpose. The purpose of the Phase I Investigation is to develop an assessment of the general conditions with respect to the safety of Foxs Lake Dam and appurtenances based upon available data and visual inspection, and determine any need for emergency measures and conclude if additional studies, investigations, and analyses are necessary and warranted.

1.2 Project Description

a. Description of Dam and Appurtenances. Foxs Lake Dam is a 19-foot high, 160-foot long earthfill and concrete dam. A 12-foot wide, concrete, ogee principal spillway is located near the center of the earthen dam embankment and is covered by a concrete deck, the top of which is approximately level with the 30-foot wide dam embankment crest. The spillway section sits between two 1-foot thick concrete walls which are approximately parallel to the flow through the spillway. These walls intersect the 1-foot thick wingwalls that form the downstream face of the spillway structure at 90° angles. Two 16-inch diameter cast iron outlet pipes protrude from this concrete face, each located about 10 feet from the centerline of flow through the principal spillway. The upstream face of the dam embankment section is grass-covered earth, sloping at about 6H:1V, intermittently protected with poorly preserved riprap. The crest of the embankment section is mostly hardpacked sand and gravel with some grass. A 4-foot high chain link fence runs along most of the upstream edge of the crest, while a 6-foot high chain link fence is located on the downstream edge of the crest. Both fences also cross the concrete principal spillway cap. The downstream face of the embankment section is rocky, tree covered natural ground, the slope of which is about 2H:1V. Essential features of the dam are given in Figures 1 & 2.

b. Location. Foxs Lake Dam is located in Morris County, New Jersey, on Foxs Brook, a tributary to the Rockaway River in the Borough of Rockaway. The dam is shown on the U.S.G.S. Quadrangle, Dover, New Jersey, with coordinates of approximately N74° 31.0' W40° 54.3'. A location map has been included as Figure 3.

c. Size Classification. Foxs Lake Dam is classified as "small" on the basis of storage at the dam crest of 97 acre-feet, which is less than 1,000 acre-feet, but more than 50 acre-feet, and on the basis of its structural height of 22 feet, which is less than 40 feet, in accordance with criteria given in Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. Foxs Lake Dam is located in a residential area. Visual inspection of the downstream area revealed two inhabited structures located about 7 feet above Foxs Brook. It is unlikely that flood stages resulting from a breach of the dam would reach the first floor sills of these structures. Damage could be appreciable but not excessive. A frequently traveled residential street spans Foxs Brook about 1400 feet downstream of the dam and could be significantly damaged by flooding associated with a breach of the dam. Because the dam is located in a populated area, loss of a few lives could be possible should the dam fail. Accordingly, Foxs Lake Dam is classified as Significant Hazard based on the criteria set forth in the Recommended Guidelines for Safety Inspection of Dams.

e. Ownership. The dam is owned by the Borough of Rockaway, 2 East Main Street, Rockaway, New Jersey, 07866. Phone: (201) 627-2000. Mr. Graner of the Public Works Department was contacted for information.

f. Purpose of Dam. The dam is used to provide recreation.

g. Design and Construction History. No information was disclosed regarding the desing and construction of the original dam.

h. Normal Operational Procedures. According to Mr. Graner, the water level of Foxs Lake is drawn down "a couple of feet" each June to allow placement of sand on the beaches. No other formal operational procedures are currently in use.

i. Site Geology. No site specific geologic information (such as borings) was available at the time the dam was inspected. Information derived from a report entitled "Engineering Geology of the Northeast Corridor, Washington, DC to Boston, MA" and the Geologic Map of New Jersey (Lewis and Kummel, 1912) indicates that soils within the immediate site area consist of till grading laterally to sand and gravel. These soils form a nearly continuous band which is interpreted to be the end moraine for the last continental glaciation. Although no outcrops were observed during inspection of this dam, the previously mentioned reports indicate that the underlying bedrock consists of granitoid gneiss with associated migmatite, granulite, amphibolite, and granitic rocks of Precambrian age.

1.3 Pertinent Data

a. Drainage Area

1.2 square miles

b. Discharge at Damsite (cfs)

Maximum flood at damsite - unknown

Ungated (total) spillway capacity at maximum pool elevation-138

Low-level outlet (if operable) - 37

c. Elevation (ft. above NGVD)

Top of dam - 615.7 (low point in crest)

Recreation pool - 613.0

Spillway crest - 613.0

Streambed at centerline of dam - 596.5 (downstream)

- 610.0 (upstream)

Maximum tailwater (estimated) - 601

d. Reservoir Length (feet)

Maximum pool - 1370

Recreation pool - 1300

e. Storage (acre-feet)

Recreation pool - 63

Design surcharge (½ PMF) - 154

Top of dam - 97

f. Reservoir Surface Area (acres)

Top of dam - 14

Recreation pool - 11

Spillway crest - 11

g. Dam

Type - earthfill and concrete

Length - 160 feet

Height - 19 feet (hydraulic)

- 22 feet (structural)

Top width - 30 feet

Side slopes - upstream 6H:1V

- downstream varies - 2H:1V to vertical

Zoning - unknown

Impervious core - unknown

Cutoff - unknown

Grout curtain - unknown

h. Spillway

Type - concrete ogee

Length of weir - 12 feet

Crest elevation - 613.0 feet above NGVD

Gates - none

Upstream channel - Foxs Lake (no approach channel)

Downstream channel - Foxs Brook

i. Regulating Outlets

Type - two 16-inch diameter cast iron pipes, downstream invert elevation - 606.8 NGVD

Length - 50 feet (estimated)

Access - gate valve installation points approximately 1 foot underground near downstream edge of dam crest on either side of spillway.

Regulating facilities - one gate valve each pipe, installed temporarily when drawdown is required.

SECTION 2
ENGINEERING DATA

2.1 Design

No plans, hydraulic or hydrologic data pertinent to Foxs Lake Dam were obtained.

2.2 Construction

No recorded data concerning construction of Foxs Lake Dam were disclosed.

2.3 Operation

No engineering operational data were disclosed.

2.4 Evaluation

a. Availability. A search of the NJDEP files and contact with community officials revealed only a limited amount of recorded information.

b. Adequacy. Because of the limited amount of recorded data available, evaluation of this dam was based solely on visual observations.

c. Validity. Parts of the recorded data retrieved were found to be incorrect based on visual observations.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. Dam. The upstream slope of the dam shows some erosion at the waterline and there are major erosion channels on the upstream slope next to the west side of the concrete spillway structure and about half-way between the spillway and the west abutment. Most of the riprap on the upstream slope is missing between the spillway and the west abutment and the riprap is in poor condition between the spillway and the east abutment. Some trees are growing on the upstream slope close to the east abutment.

The crest of the dam has a generally uneven surface and is practically bare of vegetation.

Severe erosion of the west abutment has occurred at the end of the concrete wall which retains the downstream side of the embankment. This erosion appears to be associated with trespassing on the abutment.

b. Appurtenant Structures. The downstream face of the ogee spillway is surface eroded approximately 3/4 of an inch exposing the coarse aggregate. The concrete walls on either side of the spillway are also eroded and undermined at the water line. The downstream face of the downstream retaining wall on both sides of the spillway is eroded and spalled on the inclined portion exposing the coarse aggregate. Efflorescence is also showing at many cracks in the surface of the downstream retaining walls.

Corners of the concrete deck above the spillway channel have minor spalling.

c. Reservoir Area. The watershed above the reservoir is moderately sloping; it is partly wooded and partly urbanized. Slopes adjacent to the lake appear to be stable. No evidence of significant sedimentation was observed.

d. Downstream Channel. Three trees have fallen over into the channel downstream of the dam and there are several trees hanging over the channel.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

No formal operating procedures were disclosed. It was learned that gate valves can be temporarily installed in the twin 16-inch diameter cast iron blowoff lines to facilitate reservoir lowering. The installation points on the lines are about 1 foot underground on either side of the spillway section near the downstream edge of the crest. The water level is lowered each June to allow placement of sand on the beaches for summer recreation.

4.2 Maintenance of Dam

No formal maintenance procedures for the dam were obtained. From the observed condition of the dam, it is apparent that a regular maintenance program has not been followed.

4.3 Maintenance of Operating Facilities

Formal maintenance procedures for the operating facilities do not exist.

4.4 Warning System

No warning system exists for Foxs Lake Dam.

4.5 Evaluation of Operational Adequacy

Because of the lack of operation and maintenance procedures, the remedial measures described in Section 7.2 should be implemented as prescribed.

SECTION 5
HYDROLOGIC/HYDRAULIC

5.1 Evaluation of Features

a. Design Data. An evaluation could not be performed because no data were disclosed.

b. Experience Data. Investigation of the files at the NJDEP and telephone contact with the Borough of Rockaway yielded no data concerning past overtopping of flood heights at Foxs Lake Dam.

c. Visual Observations. Some erosion of the upstream face of the dam embankment at the west side of the principal spillway structure was observed. This has left the short concrete block training wall at the west side of the spillway virtually non-functional. No evidence of overtopping of the dam crest was noted.

d. Overtopping Potential. The hydraulic/hydrologic evaluation for Foxs Lake Dam is based on a selected Spillway Design Flood (SDF) equal to one-half the probable maximum flood (PMF) in accordance with the range of test floods given in the evaluation guidelines, for dams classified as significant hazard and small in size. The PMF was determined by application of the SCS dimensionless unit hydrograph to a 24-hour probable maximum storm of 22.8 inches. Hydrologic computations are given in Appendix 3. The routed half-PMF peak discharge for the subject drainage area is 3,018 cfs.

Water will rise to a depth of 2.7 feet above the spillway crest before overtopping the low point on the dam embankment crest. Under this head the spillway capacity is 138 cfs, which is less than the selected SDF.

Flood routing calculations indicate that Foxs Lake Dam will be overtopped for more than 7 hours to a maximum depth of 3.4 feet under half-PMF conditions. It is estimated that the spillway can pass less than 5 percent of the half-PMF without overtopping the dam; thus, the spillway is considered inadequate.

e. Drawdown Capacity. Assuming that gate valves can be installed in the twin outlet pipelines, it is estimated that the lake can be drained in less than 2 days, assuming no significant inflow. This time period is considered adequate for draining the reservoir in an emergency situation.

SECTION 6
STRUCTURAL STABILITY

6.1 Visual Inspection

Erosion of the upstream slope of the dam and of the west abutment next to the concrete wall which retains the downstream side of the embankment could lead to breaching of the dam if not controlled. The poor condition of the riprap on the upstream slope has contributed to the erosion problem. The lack of vegetation on the crest of the dam makes the crest susceptible to severe erosion if the dam should be overtopped. The unevenness of the crest may be a sign of internal conditions which could adversely affect the stability of the embankment. If trees that are growing on the upstream slope blow over and pull out their roots or if trees die and their roots rot, serious seepage and erosion problems could result. Spalling, erosion, and cracking of the concrete spillway, channel walls and retaining walls could lead to instability of the structure if the deterioration continues.

6.2 Design and Construction Data

No design or construction data pertinent to the structural stability of the dam are available.

6.3 Operating Records

No operating records pertinent to the structural stability of the dam are available.

6.4 Post-Construction Changes

No records of post-construction changes pertinent to the stability of the dam are available.

6.5 Seismic Stability

This dam is in Seismic Zone 1. According to the Recommended Guidelines, dams located in Seismic Zone 1 "may be assumed to present no hazard from earthquake provided static stability conditions are satisfactory and conventional safety margins exist." None of the visual observations made during the inspection are indicative of unstable slopes. However, because no data are available concerning the engineering properties of the embankment and foundation materials for this dam or of the below-ground configuration of the concrete walls in the dam, it is not possible to make an engineering evaluation of the stability of the slopes or the factor of safety under static conditions.

SECTION 7
ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. Foxs Lake Dam is about 55 years old and is in fair condition.

b. Adequacy of Information. The information available is such that the assessment of the dam must be based primarily on the results of the visual inspection.

c. Urgency. The recommendations in 7.2 a. and 7.2 c. should be implemented by the owner as prescribed below.

d. Necessity for Additional Data/Evaluation. The information available from the visual inspection is adequate to identify the potential problems which are listed in 7.2 a. These problems require the attention of a professional engineer who will have to make additional engineering studies to design or specify remedial measures to rectify the problems. If left unattended, the problems could lead to failure of the structure.

7.2 Recommendations/Remedial Measures

a. Recommendations. The owner should retain a professional engineer qualified in the design and construction of dams to accomplish the following in the near future:

(1) Design or specify and oversee repairs for the erosion that has occurred on the upstream slope and on the west abutment.

(2) Design or specify and oversee the installation of riprap or other erosion protection on the upstream face of the dam.

(3) Design or specify and oversee the establishment of grassy vegetation for erosion protection on the crest of the embankment.

(4) Design or specify and oversee repairs to the eroded, spalled and cracked concrete on the ogee spillway, spillway walls and downstream concrete retaining walls.

(5) Specify and oversee procedures for removing trees and their root systems from the upstream slope of the dam.

(6) Further evaluate the hydrology and hydraulics of the watershed, reservoir, dam and spillway, and design and implement necessary mitigating measures.

(7) Investigate the cause of the unevenness of the crest and design and implement remedial measures if necessary.

b. Operating and Maintenance Procedures: The owner should do the following immediately:

(1) Start a program of periodically checking the condition of the dam.

(2) Control trespassing on the dam to reduce erosion.

The owner should do the following in the near future:

(1) Clear trees and brush from either side of the downstream channel for a distance of at least 50 feet downstream of the dam or to the nearest property line, whichever is closer to the dam.

(2) Establish a surveillance program for use during and after periods of heavy rainfall and also a warning program to follow in case of emergency conditions.

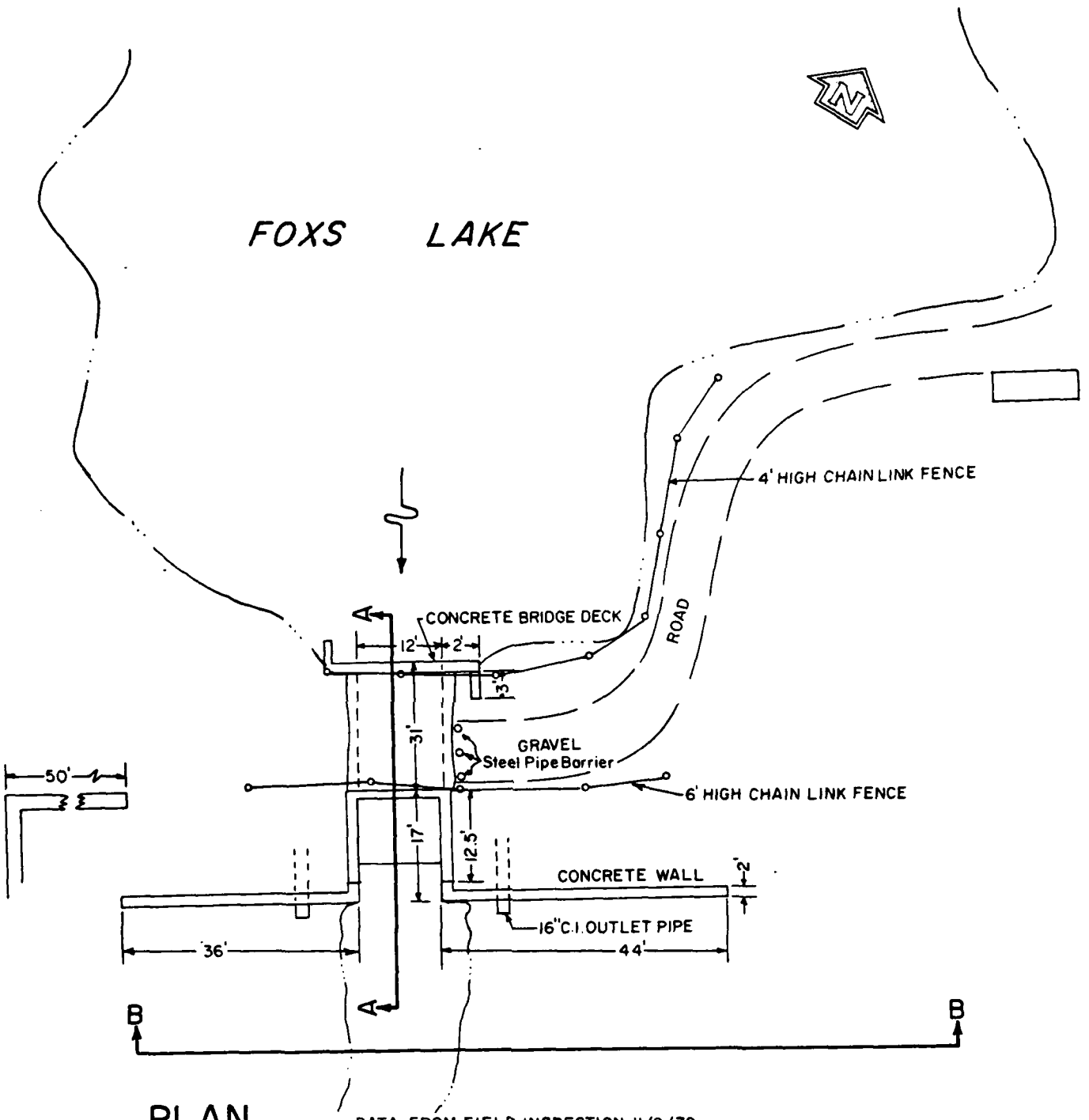
(3) Expose and clean out valve boxes to the outlet pipes.

(4) Remove the debris at the downstream toe of the spillway.

The owner should do the following in the future:

(1) Within one year from the date of approval of this report, the owner should develop written operating procedures and a periodic maintenance plan to insure the safety of the dam.

(2) The outlet valves should be exercised periodically to insure proper operation and flush any sediment that has collected in the pipes.



PLAN

DATA FROM FIELD INSPECTION 11/9/79

Anderson - Nichols & Co., Inc. CONCORD NEW HAMPSHIRE	U.S. ARMY ENGINEER DIST PHILADELPHIA CORPS OF ENGINEERS PHILADELPHIA, PA

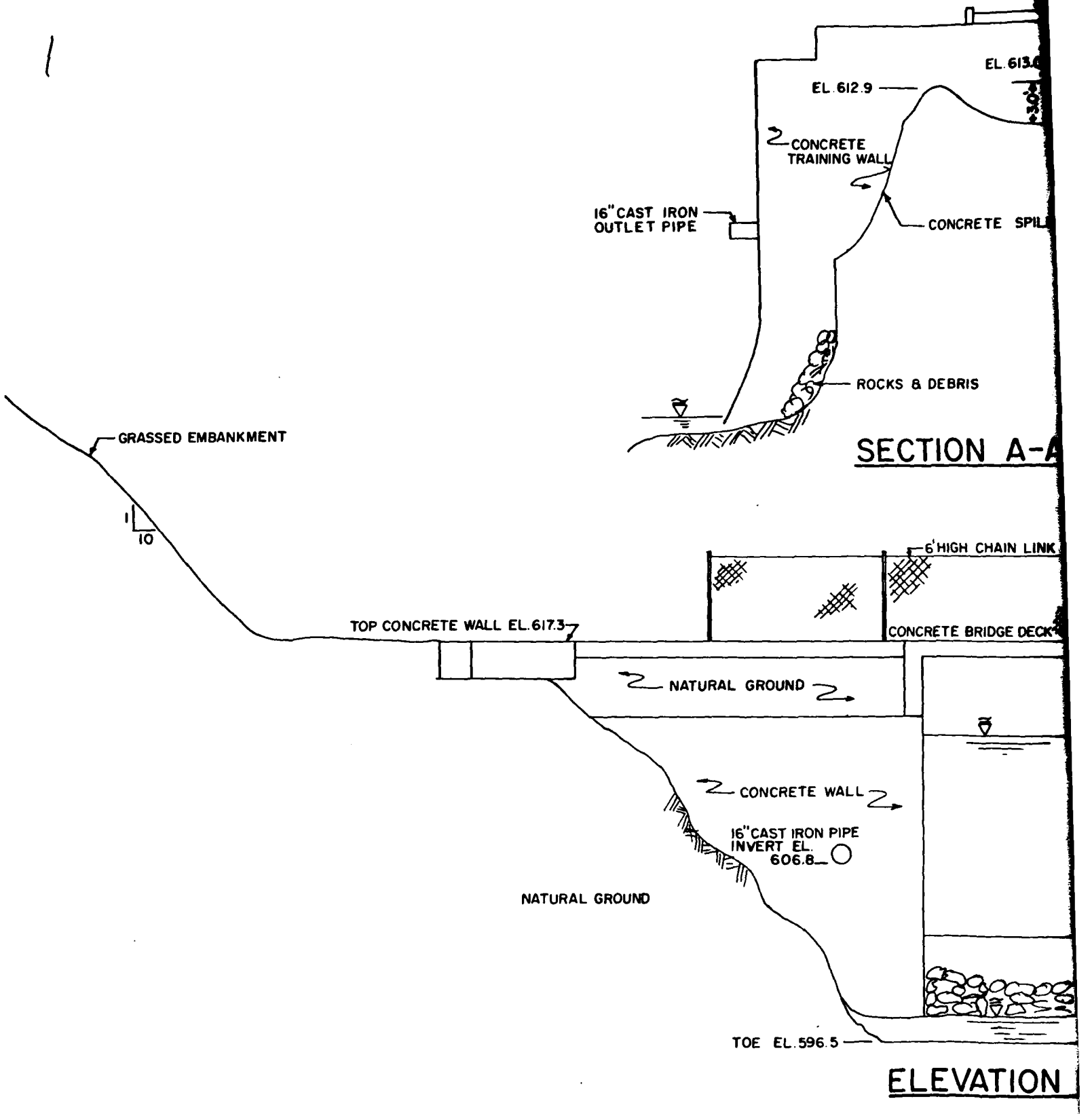
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

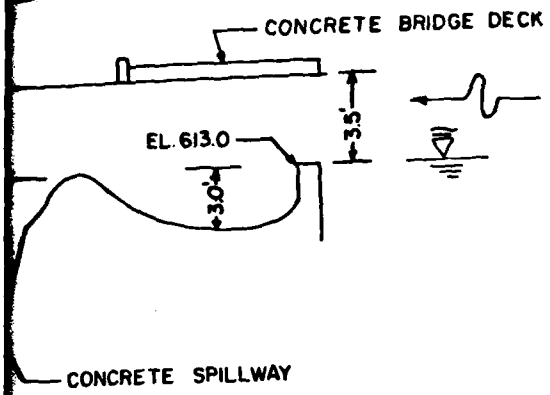
FOXS LAKE DAM

FOXS BROOK NEW JERSEY

			SCALE: NOT TO SCALE
			DATE JANUARY 1980

FIGURE 1

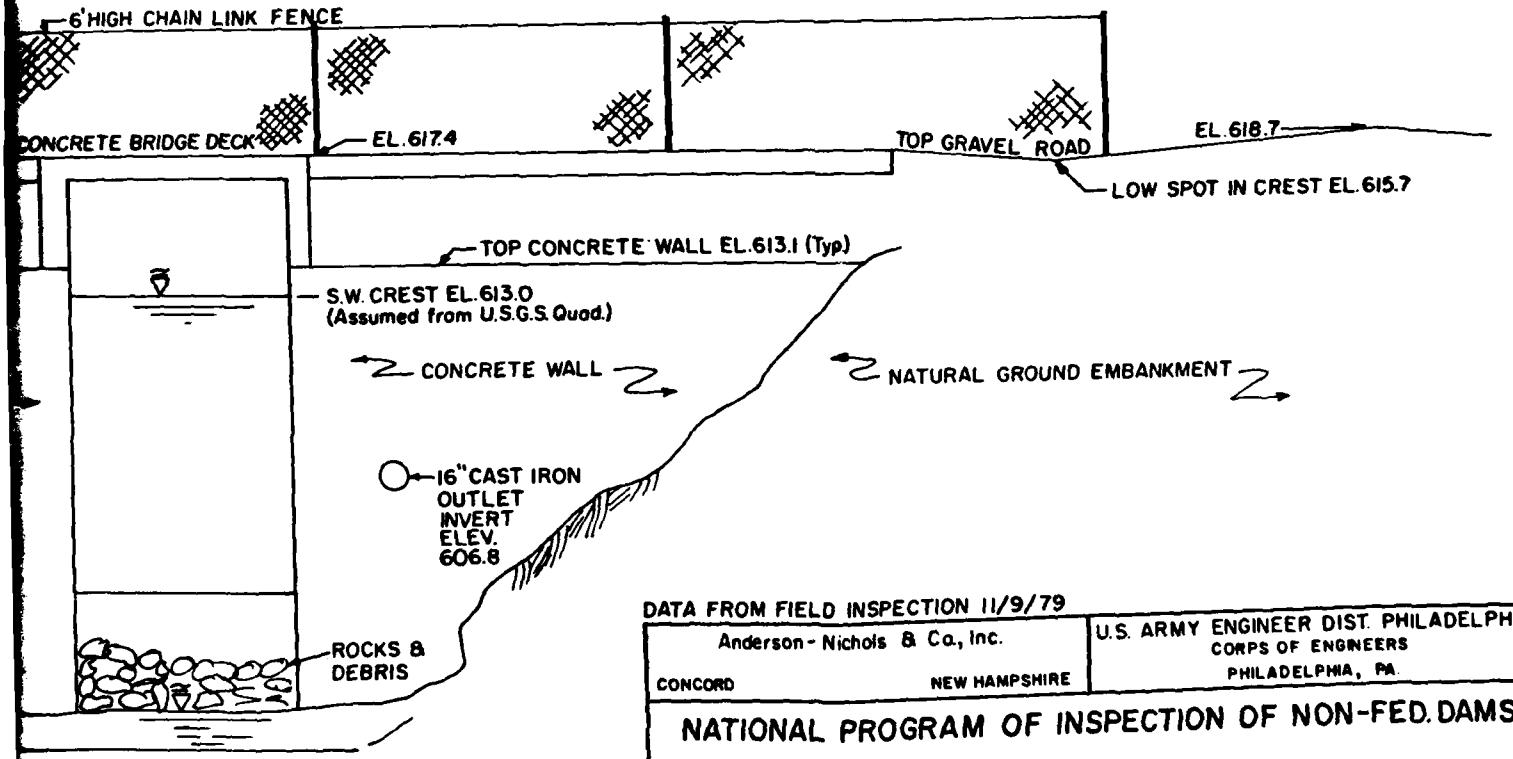

EL. 613.0
EL. 612.9
CONCRETE TRAINING WALL
16" CAST IRON OUTLET PIPE
CONCRETE SPILL
ROCKS & DEBRIS
SECTION A-A
GRASSED EMBANKMENT
1
10
6' HIGH CHAIN LINK
TOP CONCRETE WALL EL. 617.3
CONCRETE BRIDGE DECK
NATURAL GROUND
CONCRETE WALL
16" CAST IRON PIPE INVERT EL. 606.8
NATURAL GROUND
TOE EL. 596.5
ELEVATION



2

S & DEBRIS

CTION A-A



ELEVATION B-B

DATA FROM FIELD INSPECTION 11/9/79

Anderson - Nichols & Co., Inc. CONCORD NEW HAMPSHIRE	U.S. ARMY ENGINEER DIST. PHILADELPHIA CORPS OF ENGINEERS PHILADELPHIA, PA.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

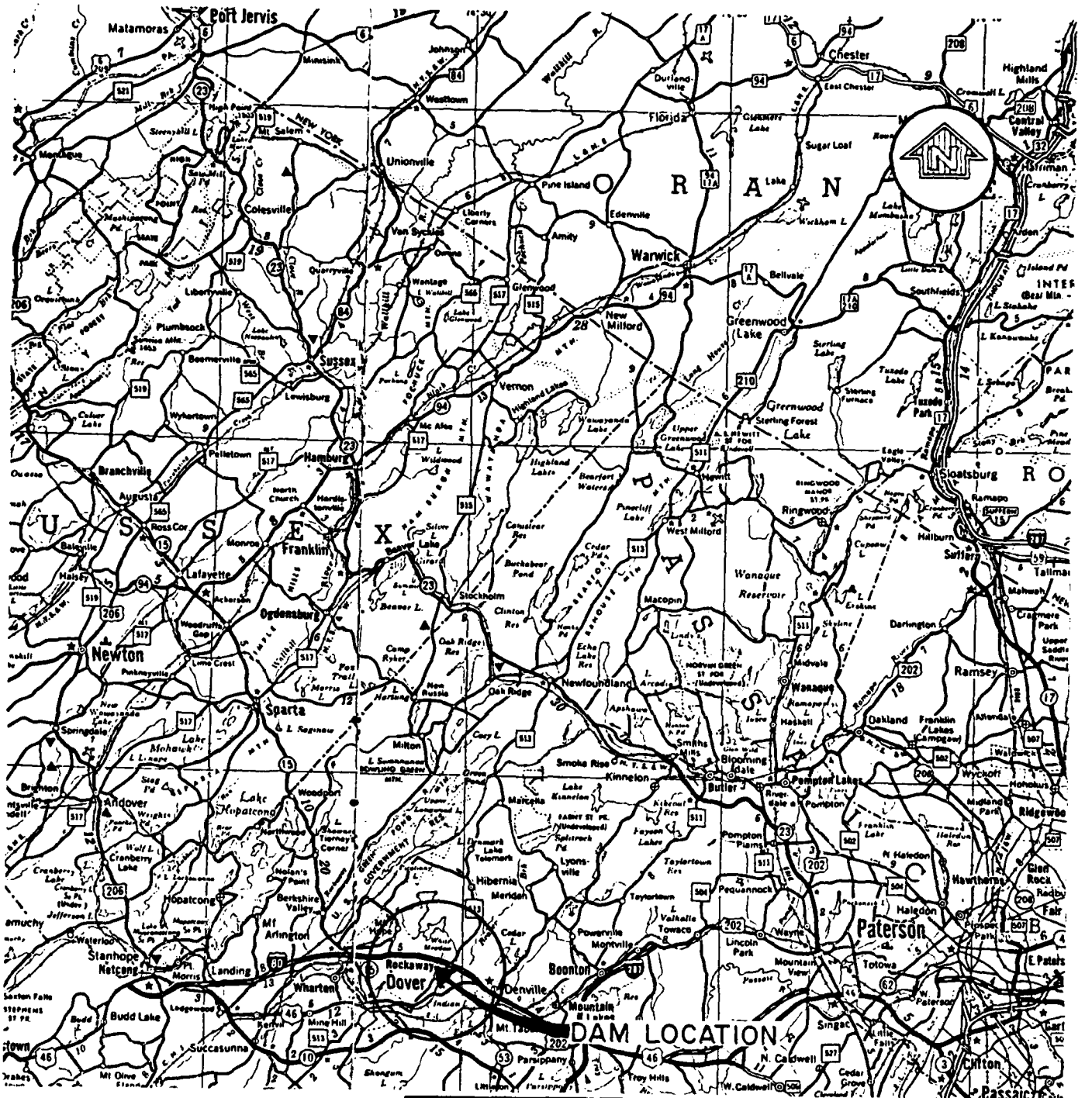
FOXS LAKE DAM

FOXS BROOK NEW JERSEY

SCALE: NOT TO SCALE

DATE: JANUARY 1980

FIGURE 2



Anderson-Nichols & Co., Inc.	U.S. ARMY ENGINEER DIST. PHILADELPHIA
CONCORD NEW HAMPSHIRE	CORPS OF ENGINEERS PHILADELPHIA, PA.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

FOXS LAKE DAM
LOCATION MAP

FOXS BROOK NEW JERSEY

			SCALE SEE BAR SCALE
			DATE JANUARY 1980

SCALE IN MILES

0 5 10

MAP BASED ON STATE OF NEW JERSEY OFFICIAL HIGHWAY MAP AND GUIDE.

FIGURE 3

APPENDIX 1

ENGINEERING AND EXPERIENCE DATA

FOXS LAKE DAM

Telephone 627-2000

Borough of Rockaway

MUNICIPAL BUILDING • 1 EAST MAIN STREET • ROCKAWAY, NEW JERSEY 07866

CHAS T. NICHOLS
Borough Clerk

July
11th
1968

RECEIVED
JUL 15 '68
DEP... DEM...
WATER POLICY AND SUPP...

Mr. Robert L. Hardman, Chief
Bureau of Water Control
N. J. Dept. of Conservation & Economic Development
Division of Water Policy & Supply
Trenton, N. J. 08625

Dear Mr. Hardman: re: Rockaway Park Lake
Dam Application No. 93

With regard to your communications of April 26th and July 3rd, 1968, please be advised that the Borough of Rockaway acquired Rockaway Park Lakes, the subject dam and surrounding shore area by Tax Foreclosure on September 12, 1941.

Trusting that this is the information that you desire, I remain,

Very truly yours,

Chas. T. Nichols

Chas. T. Nichols
Borough Clerk

P.O. Box 1390
Trenton, N.J. 08625

February 23, 1965

Mr. Martin L. Domb
Rockaway Borough Engineer
Rockaway, New Jersey

Re: Drainage from Proposed Subdivision in
Rockaway Township

Dear Mr. Domb:

This is in response to your letter of December 7 and in confirmation of our telephone conversation of January 12 concerning the jurisdiction of this Division over drainage from one municipality into another, and particularly with respect to the drainage from a proposed 523-home subdivision recently approved in Rockaway Township upstream of a branch of the Rockaway River flowing into and through the Borough Lake known as Fox Pond.

As indicated to you, the jurisdiction of this Division is restricted to the control of encroachments on natural streams, and there is no way in which we can intervene in the development of the subdivision referred to, except with respect to plans which involve fill or other construction in or adjacent to the natural stream channel, within the natural and ordinary high water mark. The criteria applied to the investigation for approval of any such plan is based on the probable runoff under conditions of expected future watershed development, which envisions the sort of subdivision that you are now concerned with, during storms of reasonable magnitude, in this instance using a flood frequency of 15 years.

Since our telephone conversation, I have reviewed the files in the matter and find that the comment made by Alfred H. Linden, Assistant Planning Director for the Morris County Planning Board, in his letter to Chairman Keiffer of the Rockaway Planning Board with respect to the safety of Fox's Pond itself is well taken. While we have no drawings descriptive of the dam construction, we find that inspections were made in 1925 and again in 1926, disclosing that a new spillway had been constructed in 1926 without prior approval by this Division as required by statute, R.S. 58:4, which relates to the structural safety and stability of dams for the prevention of the hazard to life and property due to failure and release of impounded waters. Inspection disclosed that the spillway was constructed of concrete

with a total length of 12 feet and a maximum freeboard of 4.5 feet with an estimated capacity, at the full head of 4.5 feet (dam awash) of about 400 cubic feet per second.

Our design flood at this point, where the total drainage area is 1.3 square miles, is 740 cfs for the 50-year frequency storm which is used in connection with the analysis of dams for safety and stability. While we have no way of knowing that the proposed subdivision development will itself produce a runoff of this magnitude, it is nevertheless indicated, particularly in consideration of Mr. Linden's statement that the top of the earth dam has eroded to the point that only about 20 inches of water over the spillway would result in overtopping of the dam, that the spillway is woefully inadequate, and that the Borough should immediately undertake the necessary steps to reconstruct both the dam and spillway to eliminate this potential safety hazard.

I am enclosing a copy of our booklet entitled, "Information for Applicants for Construction, Alteration or Repair of Dams", and call your attention to page 13, from which you will note that the Fox Lake dam is a Class I dam, and to page 15, specifying that a freeboard of at least one foot is required for Class I dams with small reservoirs of less than 50 acres in area.

Using these criteria, reconstruction should provide for a discharge of 740 cfs at a maximum head over the spillway crest preferably not exceeding 3 feet, even though 3.5 feet would be acceptable.

Reconstruction design and actual work should be carried out under the supervision of a competent licensed professional engineer, and all plans must be approved by this Division before work is begun. We shall be glad to consult with your engineer, at any stage, with respect to preparation of his plans for reconstruction.

Very truly yours,

Robert L. Hardman, P.E.
Chief, Bureau of Water Control

RLH:ec
enc

MORRIS COUNTY PLANNING BOARD
COURT HOUSE MORRISTOWN NEW JERSEY JEfferson 9-4300

December 2, 1964

Mr. Robert C. Keiffer, Chairman
Rockaway Planning Board
Municipal Building
Rockaway, New Jersey

Dear Mr. Kieffer:

Thank you for your letter dated September 22, 1964 concerning the proposed subdivision known as "FLEETWOOD AT ROCKAWAY" located in Rockaway Township.

By letter dated June 17, 1964 to the Rockaway Township Planning Board, we reviewed the preliminary plat of this subdivision. In that letter we discussed the drainage question relative to Fox Pond, and we quote, "However, we would like to point out that, in our opinion, the County bridges would be only a small part of the total drainage impact of this development on Fox's Brook. Although we have not examined the course of the Brook in detail, we believe that along much of its length down to Fox's Pond it has been confined to a channel of very small cross section, with walls, lawns and gardens on either side. We also believe that several footbridges and pipe culverts have been installed across it that will be completely inadequate to handle the torrents of storm water that development will produce.
(In addition, we wonder about the safety of Fox's Pond itself. A field inspection by our staff some five years ago indicated that a rise in the level of the water in the Pond to a height of only about 20 inches over the bottom of the spillway could mean water could go over the top of the earth dam, with possibly very strong damaging results. With children and weather very gradually wearing down the top of the dam (unless it has been paved since), and the possibility of a log or large plank getting stuck across the estimated 12 foot wide spillway, this does not seem like much of a safety margin for a pond of this size. The added peak flows from this development, if not checked within the tract, will certainly tend to increase any such hazard as may exist in this regard.)"

In reply to the September 3rd resolution passed by your Board, we are sorry we must inform you that the County Planning law gives us no <u>power</u> over municipal interests, nor over private property, except to the extent of protecting <u>County</u> drainage requirements.

Under the County Planning law we are enabled to advise municipal Board concerning proposed subdivisions and their effect upon the municipality. However, the municipal Board is not obligated to embrace our advisory comments.

We regret that we cannot be of more definite assistance to your Board in this matter.

Very truly yours,

MORRIS COUNTY PLANNING BOARD

M C Meadowcroft

M.C. Meadowcroft
Principal Planner

Alfred H. Linden
Assistant Planning Director

cc: Rockaway Township
Planning Board

MCM:dbc

Report of DAM INSPECTION

ROCKAWAY PARK LAKES—MORRIS COUNTY

On August 5, 1926 in company with Mr. Dean C. Jenkins, engineer, inspection was made of a dam site on the outlet of Fox Lake, tributary of the Rockaway River. The site is at a culvert beneath the Morris Canal. Location 25.3.2.8.8.

The owner is Mr. J. P. O'Conner, representing the Rockaway Park Lakes Company. Mr. O'Conner desires to place the spillway at the southern ~~part of the~~ outlet end of the old culvert in order to make it visible from the highroad.

One test pit has been sunk to a depth of 4 feet at the site of the proposed spillway. The material disclosed is a fine brown sand carrying a little clay. Mr. Jenkins was advised that it will be necessary to fill the culvert and carry the water across the top of the old canal fill by means of a watertight concrete trough. A cantilever wall design was suggested for the spillway with sheet piling cut-off.

c/f

John N. Brooks,

Hydraulic Engineer.

Trenton, New Jersey.

August 10, 1926.

APPENDIX 2

CHECK LIST

VISUAL INSPECTION

FOXS LAKE DAM

Check List
Visual Inspection
Phase 1

Name Dam Foxs Lake Dam County Morris State NJ Coordinators NJDEP

Date(s) Inspection Nov.9,1979 Weather Partly sunny,mild Temperature 70 degrees F.

Pool Elevation at Time of Inspection 613.1 NGVD Tailwater at Time of Inspection 598.0 NGVD

Inspection Personnel:

Warren Guinan	Ronald Hirschfeld
Stephen Gilman	
Janusz Czyzowski	

S. Gilman/R. Hirschfeld Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed. Downstream face of embankment is retained by vertical concrete wall	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Two erosion channels on upstream slope. Minor erosion at waterline	Repair eroded areas on upstream slope and re-establish grassy vegetation.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical alignment is not even. Horizontal alignment is good.	
RIPRAP FAILURES	Riprap on upstream slope is in poor to very poor condition.	Provide adequate erosion protection on upstream slope.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
RAILINGS		
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Very severe erosion of upstream slope at right edge of spillway structure. Very severe erosion of concrete wall which retains downstream face of embankment, apparently caused partly by trespassing	Repair eroded areas. Provide adequate erosion protection. Control trespassing
ANY NOTICEABLE SEEPAGE	None observed	
STAFF GAGE AND RECORDER	None observed	
DRAINS	None observed	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	2 Crests--Both are surface eroded exposing coarse aggregate. Channel walls are eroded and spalled where concrete is in contact with water. D/S toe spalling to a depth of 3". Face of ogee D/S is eroded exposing coarse aggregate.	Engage an Engineer to design and repair spalled and eroded concrete.
	D/S concrete walls-Numerous areas of cracking and spalling. Efflorenscence showing at majority of cracks. Worst erosion is at bottom of dam where in contact with water.	Repair spalled and eroded area.
APPROACH CHANNEL	Wide and unobstructed	
DISCHARGE CHANNEL	Three trees have fallen over into channel due to erosion of left bank. Other trees overhang channel	Clear trees and brush on either side of channel for some distance downstream from dam.
BRIDGE AND PIERS OVER SPILLWAY	Corners of concrete deck are spalled U/S ends of wall are surface eroded.	Repair spalled and eroded area

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Not applicable	
INTAKE STRUCTURE	Not visible	
OUTLET PIPE - Two 16"cast iron	Pipes are in good condition, only minor surface rust	No action required
OUTLET CHANNEL	see d/s channel of ungated spillway	
EMERGENCY GATE -two 16"gate valves	Not visible	Expose valve boxes and exercise valves periodically to insure operation and flush out sediment

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None observed	
OBSERVATION WELLS	None observed	
WEIRS	None observed	
PIEZOMETERS	None observed	
OTHER	None observed	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gently sloping. Homes on shoreline	
SEDIMENTATION	No evidence of significant sedimentation observed.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Rocky bottom, few small trees fallen into channel, others overhanging channel. Small breached dam just upstream of first culvert encountered downstream of dam.	
SLOPES	Narrow channel, low channel banks, moderate to flat sloping overbanks.	
APPROXIMATE NO. OF HOMES AND POPULATION	Two homes--sills are both at least 7 feet above streambed; less than 10 total inhabitants.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	None disclosed
REGIONAL VICINITY MAP	Prepared for this report
CONSTRUCTION HISTORY	None
TYPICAL SECTIONS OF DAM	None
HYDROLOGIC/HYDRAULIC DATA	None
OUTLETS - PLAN	None
- DETAILS	None disclosed
- CONSTRAINTS	None disclosed
- DISCHARGE RATINGS	None disclosed
RAINFALL/RESERVOIR RECORDS	None disclosed

ITEM	REMARKS
DESIGN REPORTS	None disclosed
GEOLOGY REPORTS	None disclosed
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None disclosed
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None disclosed
POST-CONSTRUCTION SURVEYS OF DAM	None disclosed
BORROW SOURCES	Unknown

ITEM	REMARKS
MONITORING SERVICES	None
MODIFICATIONS	None
HIGH POOL RECORDS	None
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	None

ITEM	REMARKS
SPILLWAY PLAN	
SECTIONS	Prepared for this report from field inspection data
DETAILS	None
OPERATING EQUIPMENT	Two 16-inch diameter gate valves
PLANS & DETAILS	None

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 1.2 sq. miles, residential, hilly

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 613.0 NGVD (63ac-ft)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): not applicable

ELEVATION MAXIMUM DESIGN POOL: 619.1 NGVD (half-PMF)

ELEVATION TOP DAM: low pt. 615.7 NGVD

CREST: restricted flow over concrete

a. Elevation 613.0 NGVD

b. Type concrete ogee

c. Width 31 ±

d. Length 12'

e. Location Spillover right center of dam

f. Number and Type of Gates none

OUTLET WORKS: twin low level outlet pipes

a. Type 16 inch diameter cast iron

b. Location each 10' from centerline of flow through principal spillway

c. Entrance Inverts 607 NGVD

d. Exit Inverts 606.8 NGVD

e. Emergency Draindown Facilities none

HYDROMETEORLOGICAL GAGES: none

a. Type

b. Location

c. Records

MAXIMUM NON-DAMAGING DISCHARGE: 138. CFS

APPENDIX 3

PHOTOGRAPHS

FOXS LAKE DAM

9 NOV 1979
Looking southeast at upstream face of dam embankment and principal spillway.

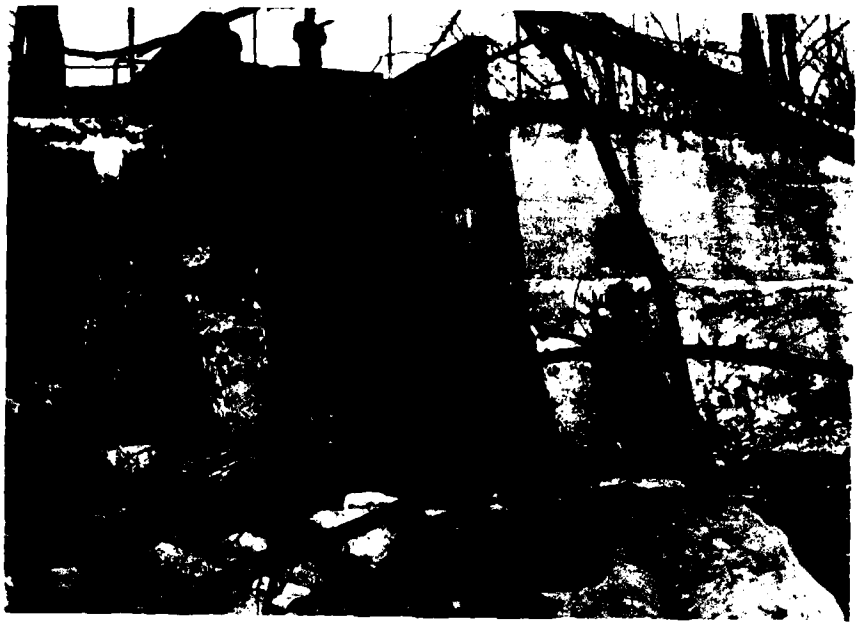
9 NOV 1979
Looking south at upstream face of dam embankment (west end).

9 NOV 1979

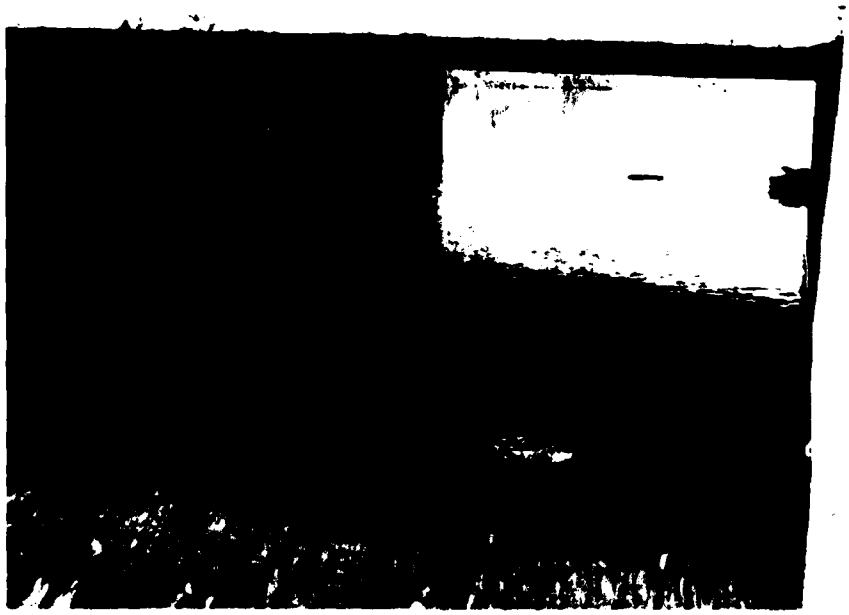
Looking east across upstream face at entrance to principal spillway. Note undermined training wall and embankment erosion.

9 NOV 1979

Looking southwest across dam crest.



9 NOV 1979
Looking north at downstream face of principal spillway structure. Note twin blowoff pipes set in concrete at either side of ogee spillway.



9 NOV 1979
Looking northwest through principal spillway opening at upstream reservoir.

9 NOV 1979
Looking north at upstream reservoir from dam crest.

9 NOV 1979
Looking upstream at spalled face of concrete wall adjacent to principal spillway toe.

9 NOV 1979
Looking downstream at Foxs Brook just below Foxs Lake Dam.

9 NOV 1979
Looking downstream at entrance to first culvert encountered downstream of Foxs Lake Dam.

9 NOV 1979
Looking downstream at channel just below first culvert.

APPENDIX 4

HYDROLOGIC COMPUTATIONS

FOXS LAKE DAM

Anderson-Nichols & Company, Inc.

Subject FOXS LAKE DAM

Sheet No. 1 of 16
Date 4 Dec 79
Computed GHK
Checked DFDD

JOB NO. 3409-01

SQUARES 1/4 IN SCALE

HYDROLOGIC COMPUTATIONS

Drainage area = 1.2 mi^2

Lake surface area (normal pool) = 11 acres

Evaluation criteria
size: small
hazard: significant

Spillway design flood
Based on size and hazard classification, the selected spillway design flood will be one half the probable maximum flood (1/2 PMF).

SQUARES 1/4 IN SCALE

DETERMINE TIME OF CONCENTRATION, T_C

Method 1 *

Estimate velocity

overland flow
reach length = 4600 ft.
slope = $\frac{790-650}{4600} = 0.03$
from table, mostly residential ("pastures")
average velocity = 1.5 fps.

channel flow
reach length = 1800 ft (including lake)
slope = $\frac{650-613}{1800} = 0.02$
from table, V avg. = 3 fps

$T_C = \frac{4600}{1.5} + \frac{1800}{3} = 3667 \text{ sec} \div 61.1 \text{ min.}$

Method 2 ▽

from group C, runoff curve No. = 77

from nomograph, $T_L = 0.39$ hrs.

$T_C = 1.67\, T_L = 1.67(0.39) = 0.65 \text{ hrs} \div \underline{39 \text{ min.}}$

* from "Design of Small Dams", Bureau of Reclamation.

▽ Soil and Water Conservation Engineering, SCS.

Anderson-Nichols & Company, Inc.

Subject FOXS LAKE.

Sheet No. 3 of 16
Date 4 Dec 79
Computed GAS
Checked FDD

JOB NO. 3409-01

SQUARES 1/4 IN SCALE

Method 3*

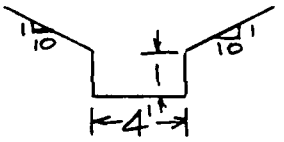
Overland flow
slope = 0.03 (see Method 1.)

overland flow occurs mostly over a residential area (lawns);

from plot of % of slope vs. velocity,

$V = 1.3$ fps

Channel flow
estimate channel shape



assume depth of water in channel = 1 ft.

$A = 4(1) = 4\ ft^2$

$R = \frac{A}{WP} = \frac{4}{2(1)+4} = 0.67$

$V = \frac{1.49}{n} R^{2/3} S^{1/2}$

$S = 0.02,\ R = 0.67,\ n = 0.045$

from Manning's nomograph, $V = 3.4$ fps

$T_c = \frac{4600}{1.3} + \frac{1800}{3.4} = 4068 \text{ sec} = \underline{67.8 \text{ min.}}$

* Weston Method (SCS)

SQUARES 1/4 IN. SCALE

Method 4 *

$$T_C = 0.83\left(\frac{NL}{\sqrt{S}}\right)^{0.467}$$

overland flow

$N = 0.20$, $S = 0.03$, $L = 4600$ ft

$$T_{C_{OV}} = 0.83\left(\frac{0.20(4600)}{\sqrt{0.03}}\right)^{0.467} = 45.6 \text{ min.}$$

channel flow

from Manning's nomograph, $V = 3.4$ fps (see Method 3)

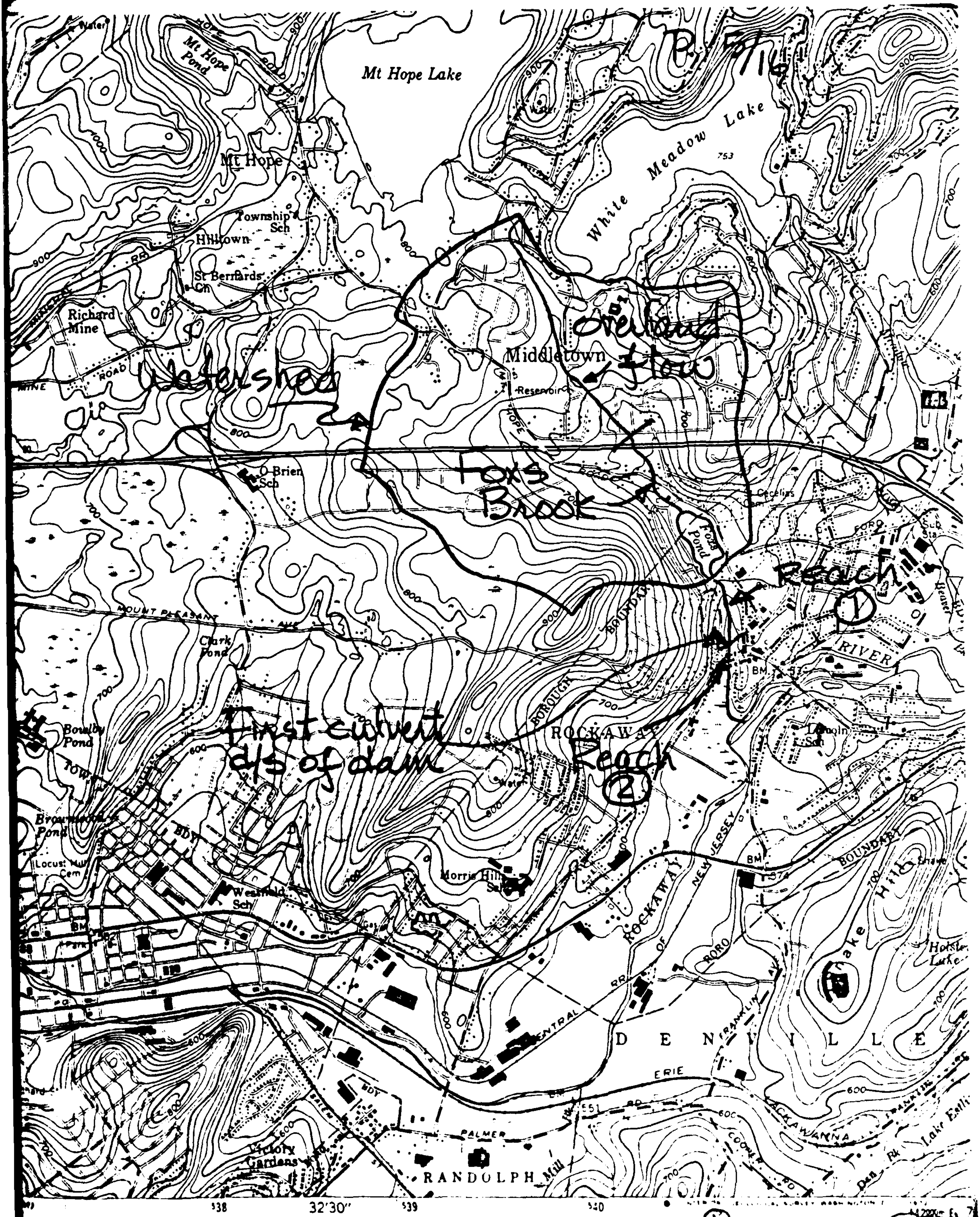
$$T_{C_{Ch}} = \frac{1800}{3.4} = 529 \text{ sec} = 8.8 \text{ min.}$$

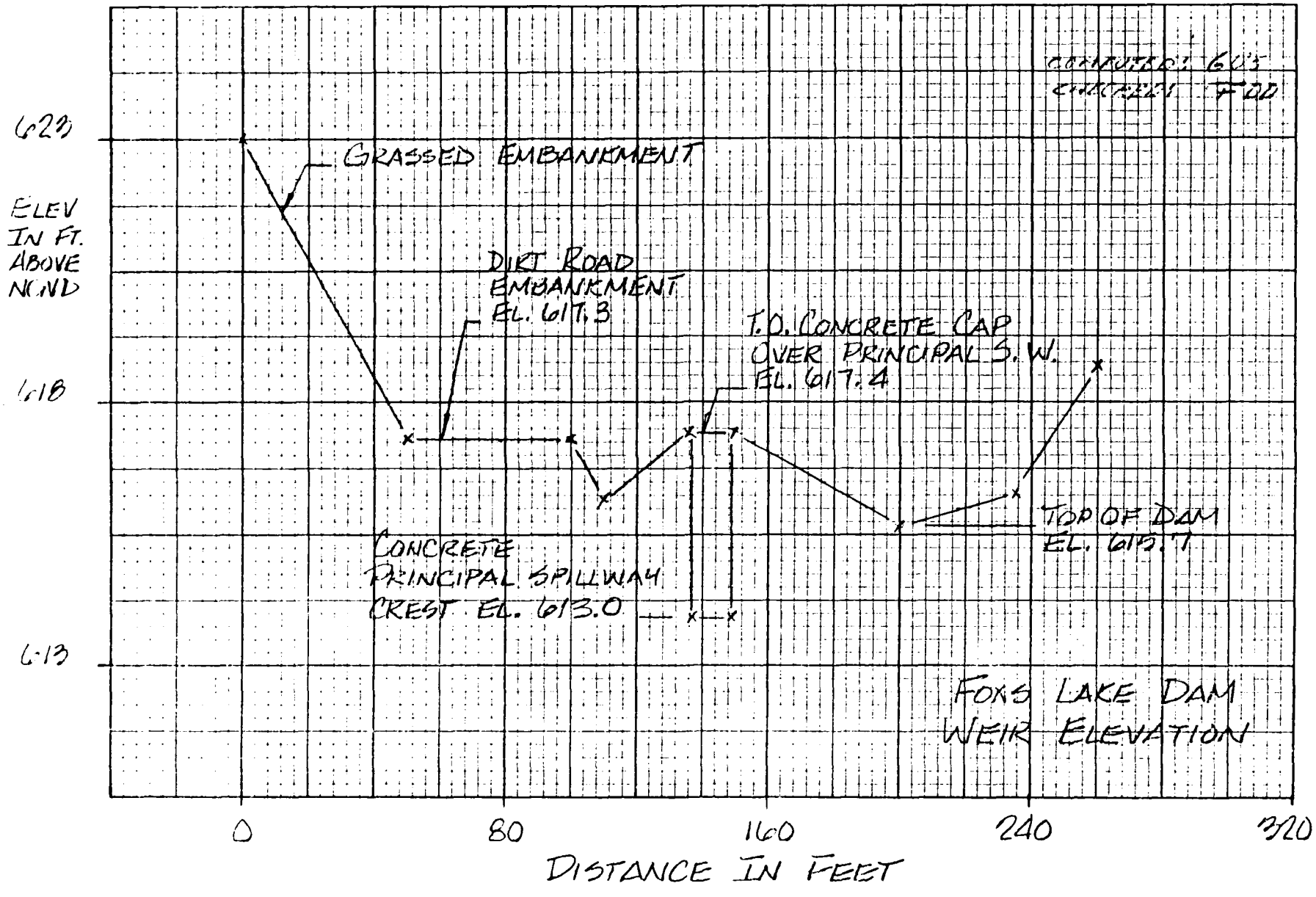
$$T_C = 45.6 + 8.8 = \underline{54.4 \text{ min.}}$$

$$T_{C_{AVG}} = \frac{61 + 39 + 68 + 54}{4} = 55.5 \text{ min} = \underline{0.93 \text{ hr.}}$$

$$T_{LAG} = 0.6\, T_C = 0.6(0.93) = 0.56 \text{ hr.}$$

* Kerby Method


P. 5/14
Mt Hope Lake
Mt Hope Pond
Mt Hope
Township Sch
Hilltown
St Bernards Ch
Richard Mine
MINE ROAD
White Meadow Lake
753
Middletown
Reservoir
Overland Flow
Watershed
Foxs Brook
O Brien Sch
Cecelias
Foxs Pond
Reach 1
MOUNT PLEASANT AVE
Clark Pond
RIVER
BOROUGH
BOUNDARY
ROCKAWAY
First culvert d/s of dam
Reach 2
Boulby Pond
Lincoln Sch
Brownwood Pond
Locust Hill Cem
Westfield Sch
Morris Hills Sch
ROCKAWAY
NEW JERSEY
BORO
Lake Hill
Holstein Lake
CENTRAL RR OF
FRANKLIN AV
D E N V I L L E
ERIE
LACKAWANNA
PALMER
COOPER RD
Victory Gardens
RANDOLPH
Mill
Den Rk
Lake Ellis
538
32'30"
539
540
(1)


623
618
613
ELEV IN FT. ABOVE NGVD
GRASSED EMBANKMENT
DIRT ROAD EMBANKMENT EL. 617.3
T.O. CONCRETE CAP OVER PRINCIPAL S.W. EL. 617.4
CONCRETE PRINCIPAL SPILLWAY CREST EL. 613.0
TOP OF DAM EL. 619.7
FOXS LAKE DAM WEIR ELEVATION
0
80
160
240
320
DISTANCE IN FEET

Anderson-Nichols & Company, Inc. Subject FOXS LAKE Sheet No. 7 of 16
JOB NO. 3409-01 Date 5 Dec 79 Computed SJS Checked JDD

DEVELOP RATING CURVE AT DAM

Flow over spillway

Use weir equation, $Q = CLH^{3/2}$, for flow over spillway while a free surface is maintained... $C = 2.6^{*}$, H varies

Use orifice equation, $Q = Ca\sqrt{2gh}$, for pressure flow...

$$C^{\nabla} = \left(1 + 0.4r^{0.3} + \frac{0.0045L}{r^{1.25}}\right)^{-1/2}$$

$$r = \frac{3.5(12)}{2(3.5) + 2(12)} = 1.35$$

$$C = \left(1 + 0.4(1.35)^{0.3} + \frac{0.0045(30)}{(1.35)^{1.25}}\right)^{-1/2}$$

$C = 0.81$
$a = 12(3.5) = 42\ ft^2$
h = water surface − ℄ opening = W.S. − 614.8

Flow over dam crest

Use weir equation, $Q = CLH^{3/2}$ where $C = 2.4$ and H varies

* from table 5-3, p. 5-40, Brater & King, Handbook of Hydraulics.
$^{\nabla}$ Equation 4-37, p. 4-24, B & K, Handbook of Hydraulics.

Anderson-Nichols & Company, Inc.

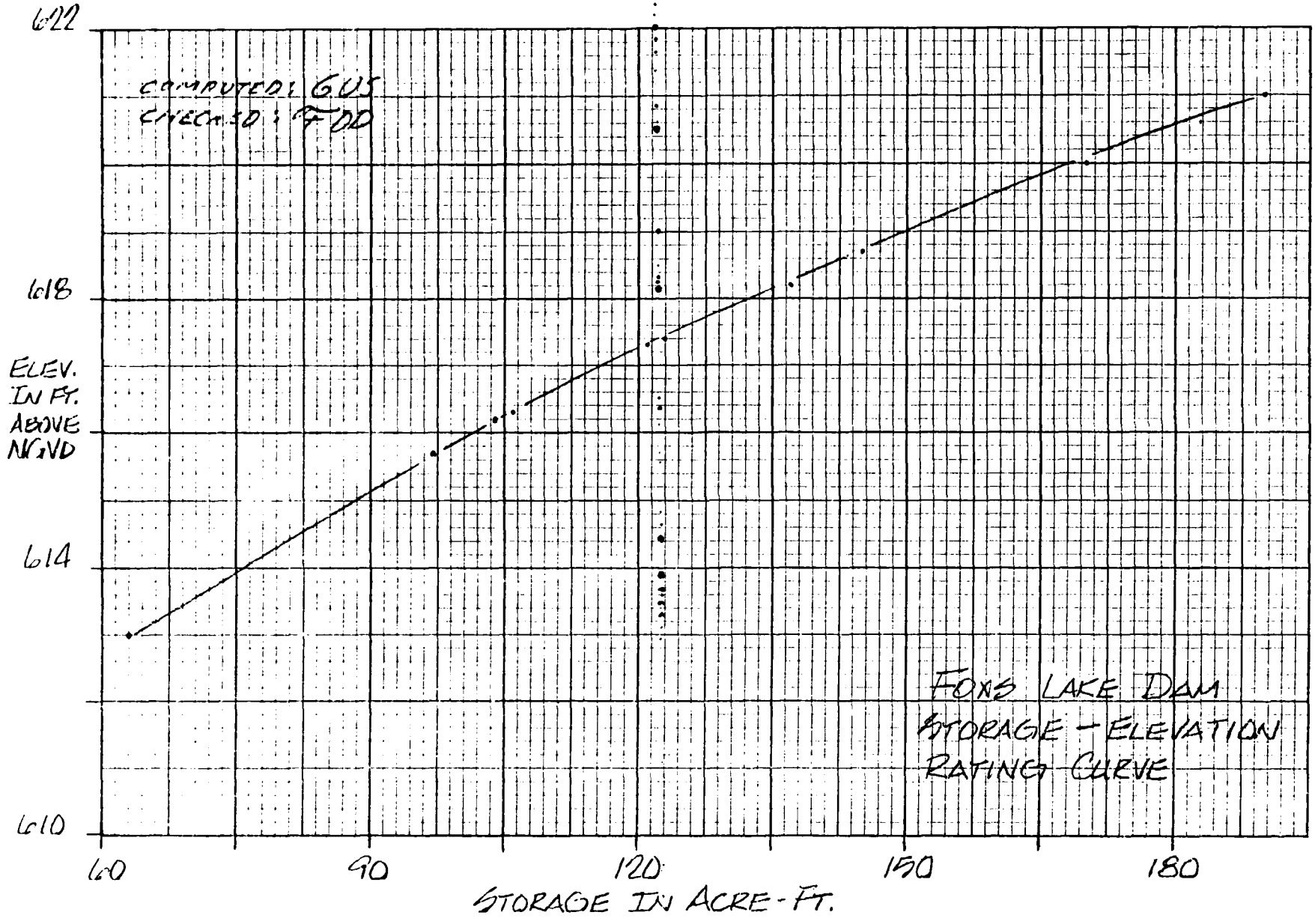
JOB NO. 3409-01

Subject FOXS LAKE

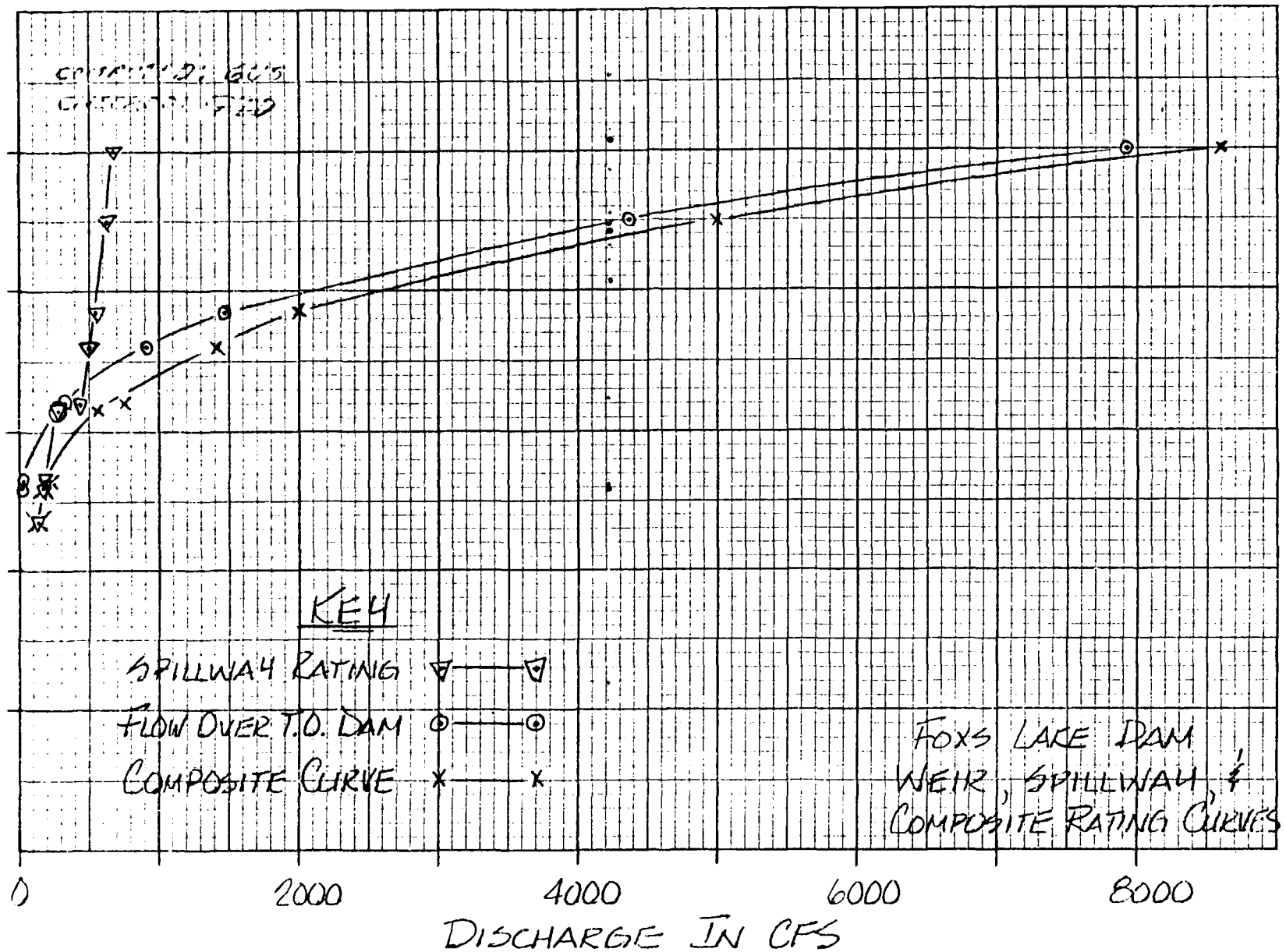
Sheet No. 8 of 16
Date 5 DEC 79
Computed GLS
Checked FDD

ELEVATION (FT. ABOVE MSL)	SPILLWAY			TOP OF DAM			Q TOTAL
	HEAD (ft)	Q_{weir} (cfs)	$Q_{orif.}$ (cfs)	HEAD* (ft)	LENGTH (ft)	Q (cfs)	
613.0							0
615.7	2.7	138					138
616.2	3.2	179		0.5	23	19	198
616.3	3.3	187		0.6	29	30	217
617.3	4.3	278		1.2	100	280	558
617.4			440	0.8	190	323	763
618.2			503	1.5	258	905	1408
618.7			539	1.4	373	1456	1997
620.0			623	1.9	684	4364	4987
621.0			680	2.7	739	7923	8603

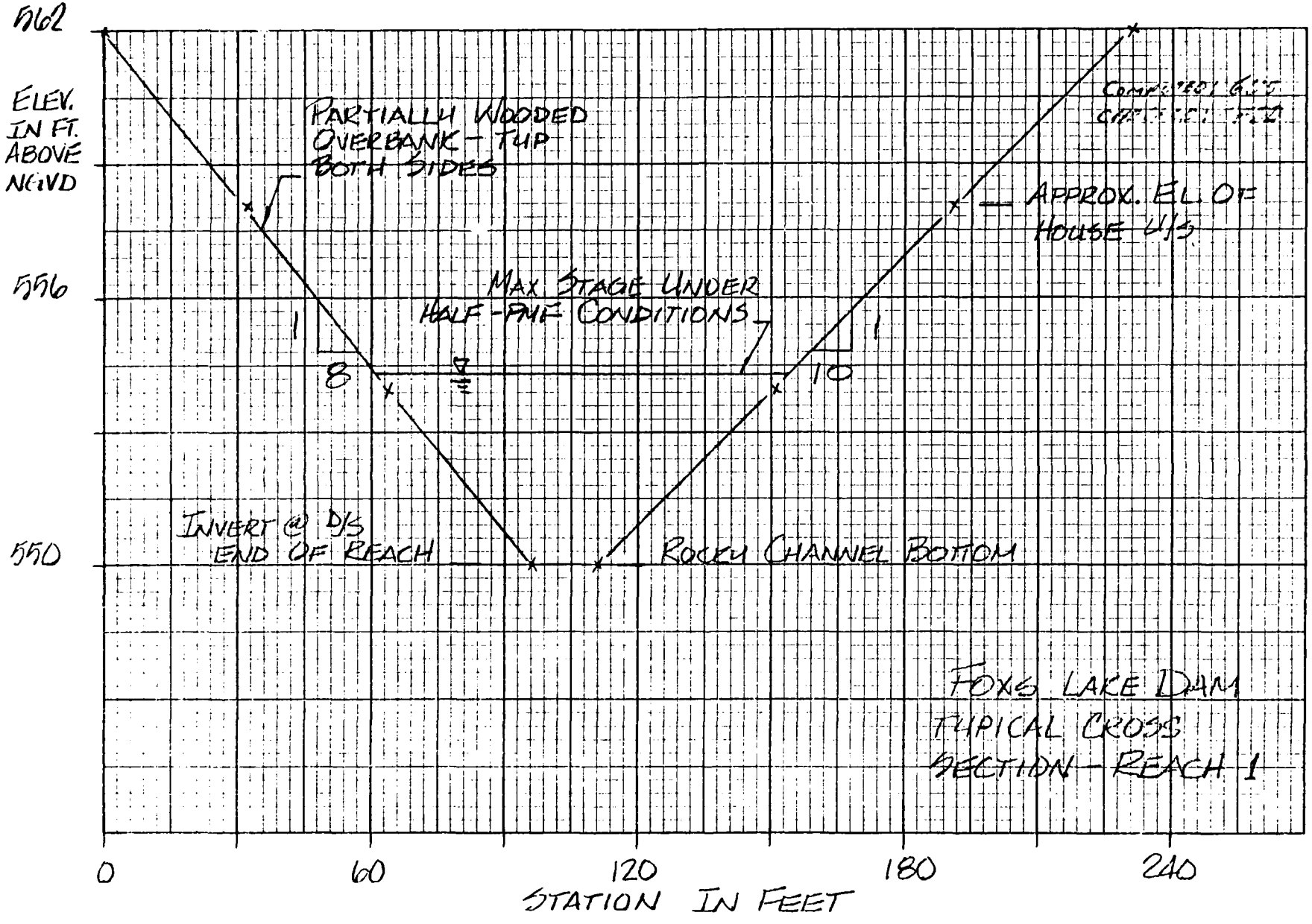
* Average value

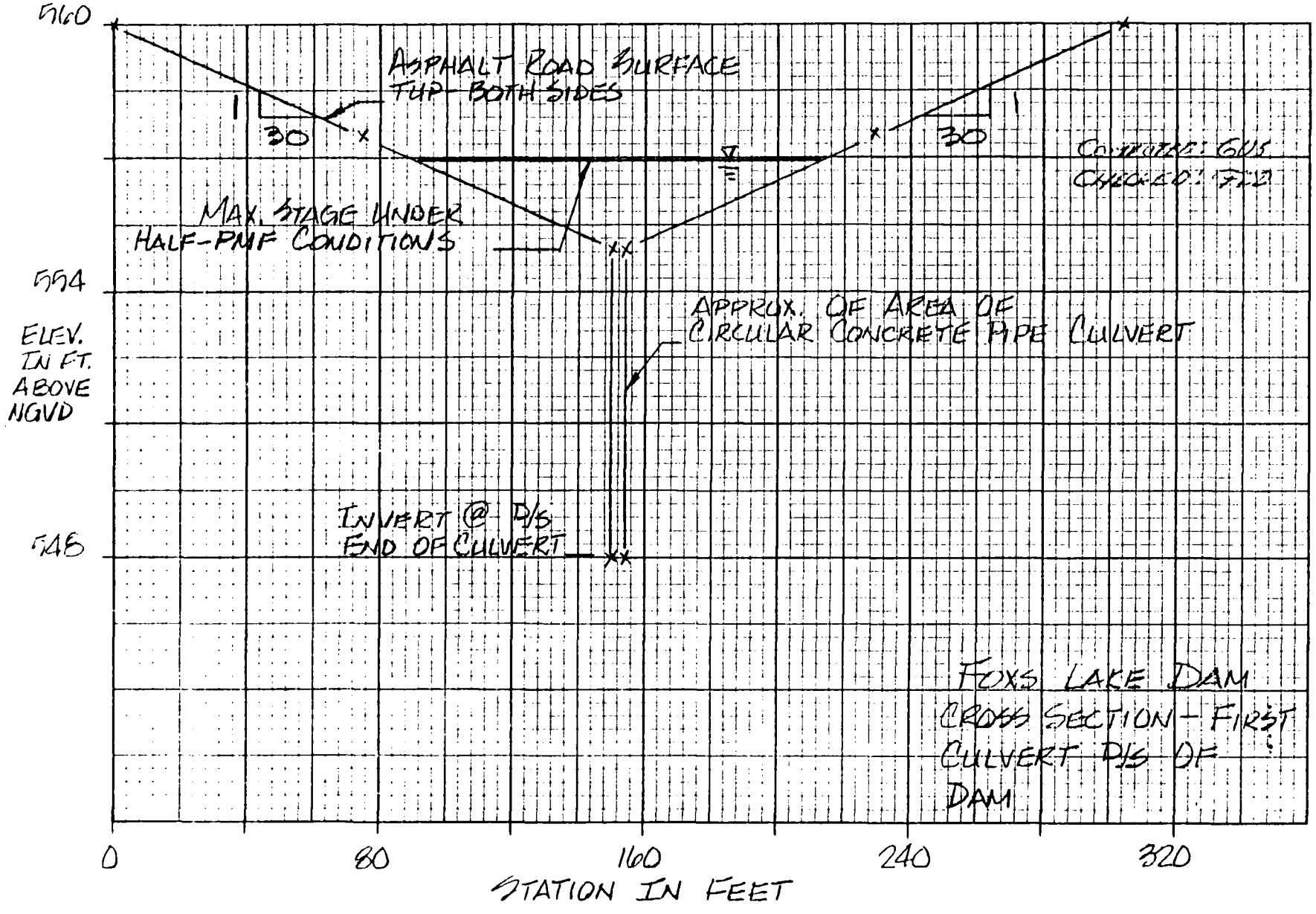

622
618
614
610
ELEV. IN FT. ABOVE NGVD
COMPUTED: GUS
CHECKED: FDD
FOXS LAKE DAM
STORAGE - ELEVATION
RATING CURVE
60
90
120
150
180
STORAGE IN ACRE-FT.

9/16

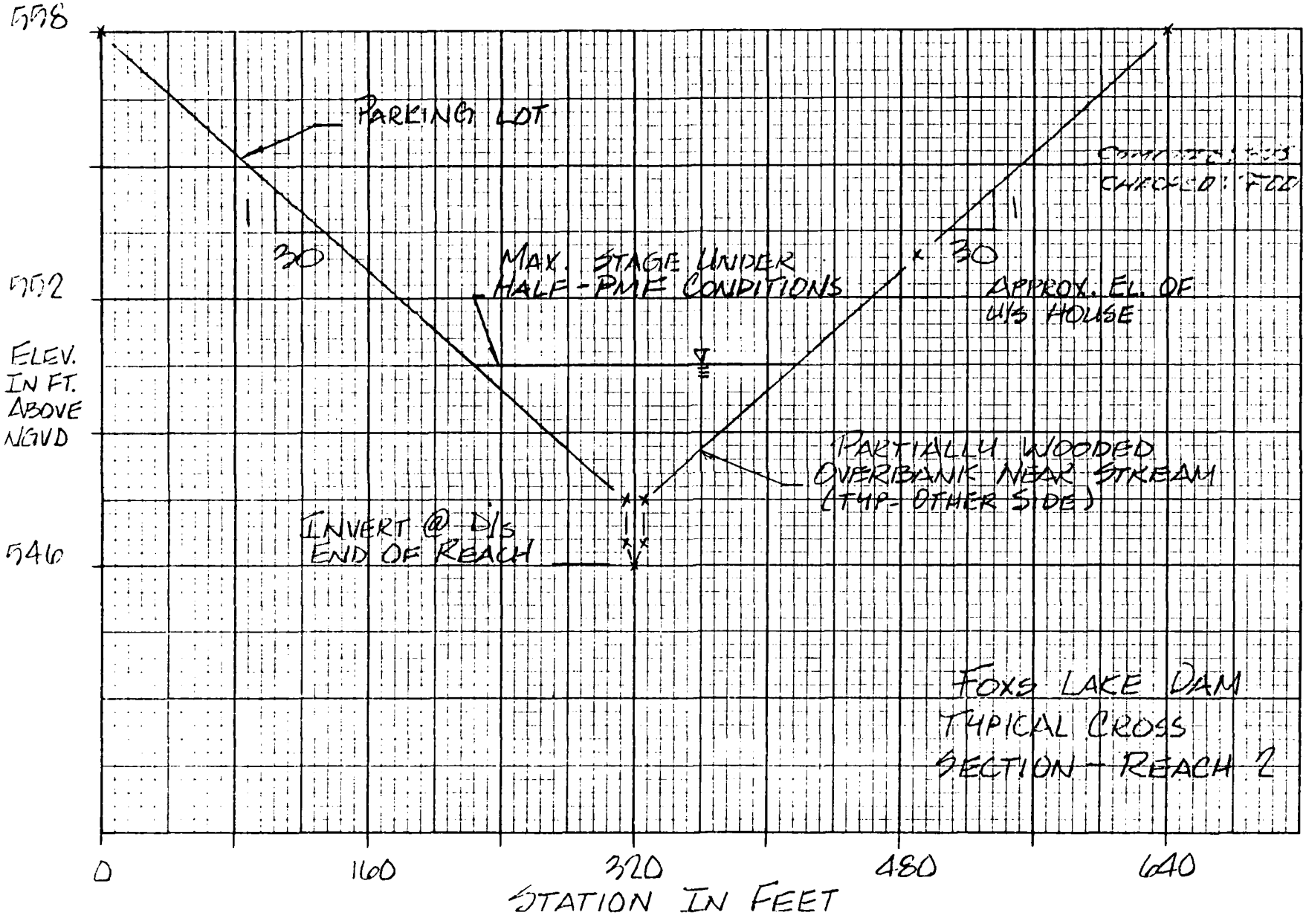

621
ELEV. IN FT. ABOVE NGVD
617
613
KEY
SPILLWAY RATING
FLOW OVER T.O. DAM
COMPOSITE CURVE
FOXS LAKE DAM
WEIR, SPILLWAY, & COMPOSITE RATING CURVES
0
2000
4000
6000
8000
DISCHARGE IN CFS

9/01


562
ELEV. IN FT. ABOVE NGVD
556
550
PARTIALLY WOODED OVERBANK - TYP BOTH SIDES
MAX STAGE UNDER HALF-PMF CONDITIONS
APPROX. EL OF HOUSE U/S
1
8
1
10
INVERT @ D/S END OF REACH
ROCKY CHANNEL BOTTOM
FOXS LAKE DAM
TYPICAL CROSS SECTION - REACH 1
0
60
120
180
240
STATION IN FEET


5760
5594
5548
ELEV. IN FT. ABOVE NGVD
ASPHALT ROAD SURFACE TOP BOTH SIDES
30
30
MAX. STAGE UNDER HALF-PMF CONDITIONS
APPROX. OF AREA OF CIRCULAR CONCRETE PIPE CULVERT
INVERT @ D/S END OF CULVERT
0
80
160
240
320
STATION IN FEET
FOXS LAKE DAM
CROSS SECTION - FIRST CULVERT D/S OF DAM

9/1/21


558
552
546
ELEV. IN FT. ABOVE NGVD
PARKING LOT
3:0
MAX. STAGE UNDER HALF-PMF CONDITIONS
3:0
APPROX. EL. OF U/S HOUSE
PARTIALLY WOODED OVERBANK NEAR STREAM (TYP. OTHER SIDE)
INVERT @ D/S END OF REACH
0
160
320
480
640
STATION IN FEET
FOXS LAKE DAM
TYPICAL CROSS SECTION - REACH 2

13/16

Anderson-Nichols & Company, Inc.

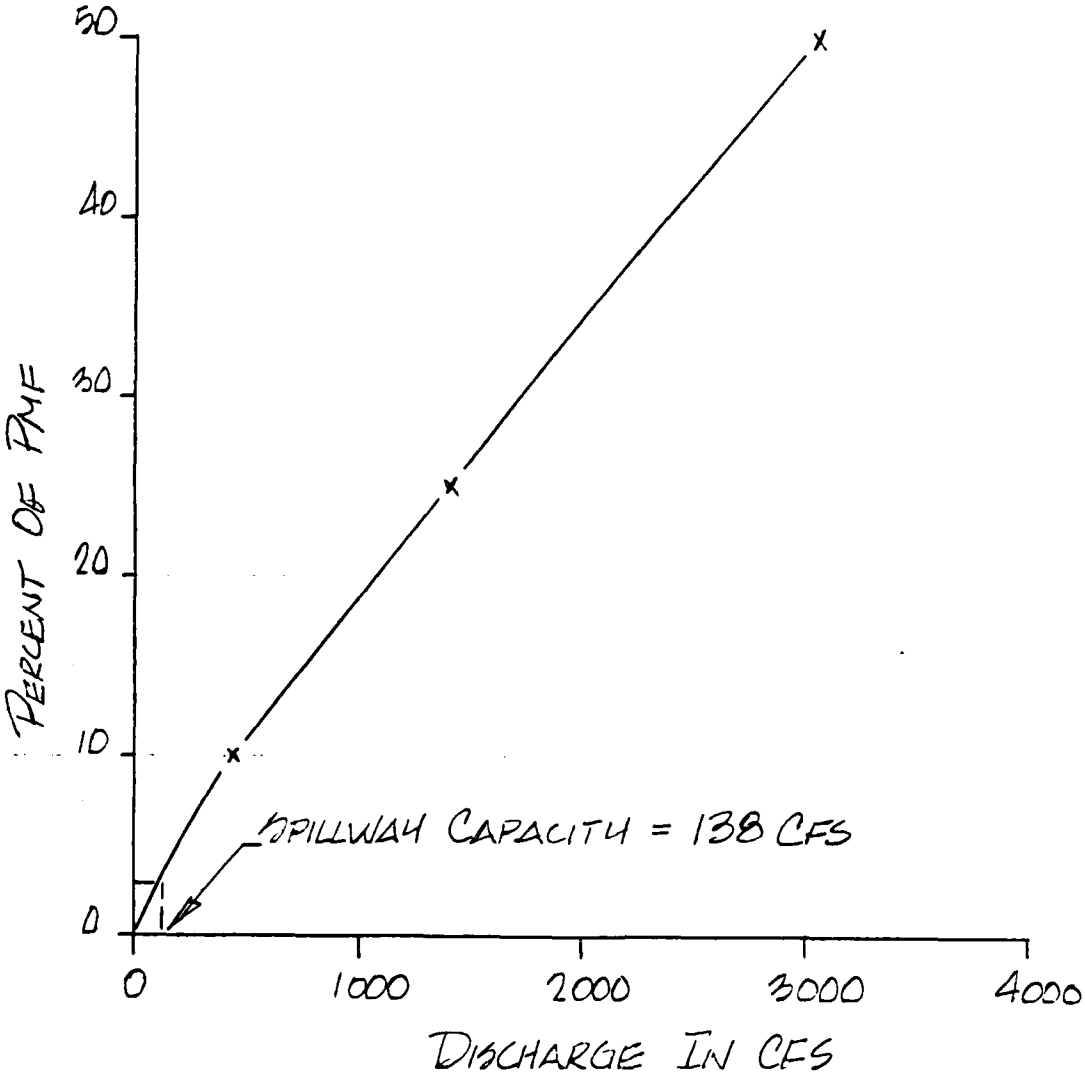
Subject FOXS LAKE

Sheet No. 14 of 16
Date 26 Dec 79
Computed GWS
Checked

JOB NO. 3409-01

SQUARES 1/4 IN SCALE

OVERTOPPING POTENTIAL



SQUARES 1/4 IN SCALE

DETERMINE "C" FOR LOW LEVEL OUTLET PIPES

Each Pipe:

D = diameter = 16 in.

n = 0.013 (from Soil and Water Conservation Engineering*, p. 632)

A_p = area of pipe opening = 1.4 ft^2

L_p = length of pipe = 50 ft.

K_f = friction loss through pipe

K_L = entrance loss to pipe = 0.8 (p. 639*)

C_p = coefficient of discharge (incorporating A_p & 2g)

C = coefficient of discharge

$$K_f = \frac{5087\, n^2}{D^{4/3}} = \frac{5087\,(0.013)^2}{(16)^{4/3}} = 0.021$$

$$C_p = A_p \sqrt{\frac{2g}{1 + K_L + K_f L_p}} = 1.4 \sqrt{\frac{64.4}{1 + 0.8 + 0.021(50)}} = 6.66$$

$$C = \frac{C_p}{A\sqrt{2g}} = \frac{6.66}{1.4\sqrt{2g}} = \frac{0.59}{\sqrt{g}}$$

Anderson-Nichols & Company, Inc.

Subject FOXS LAKE

Sheet No. 16 of 16
Date 22 Jan 80
Computed DBF
Checked JDD

JOB NO. 3409-01

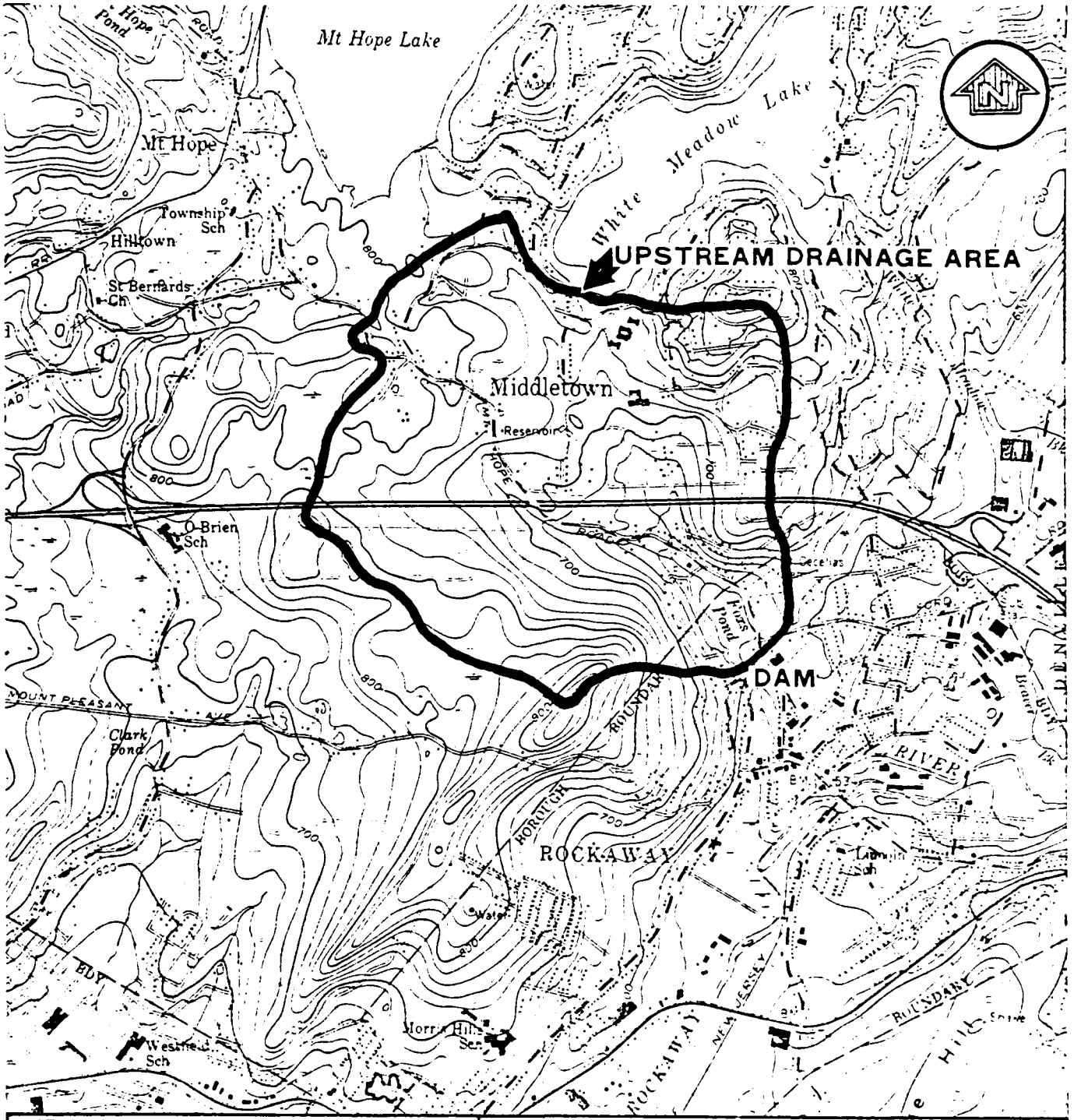
DRAWDOWN CALCULATIONS

Assume: ① No significant inflow
② Two 16" ϕ outlet pipes are operational
③ $Q_p = C_p H^{1/2} = 6.66 H^{1/2}$
④ Ac-Ft/day $= 1.9835 \cdot Q_{AVG}$
⑤ Days = ΔStorage / Ac-Ft/day

ELEV.-FT. ABOVE NGVD	STORAGE AC-FT	ΔS AC-FT	H FT.	Q▽ CFS	Q_{AVG} CFS	AC-FT PER DAY	DAYS
613.0	63		5.5	32			
		11			30	59.5	0.18
612.0	52		4.5	28			
		10			26	51.6	0.19
611.0	42		3.5	24			
		9			22	43.6	0.21
610.0	33		2.5	20			
		8			18	35.7	0.22
609.0	25		1.5	16			
		6			13	25.8	0.23
608.0	19		0.5	10			
		5			5	9.9	0.51
607.5	14		0	0			

Σ = 1.54 DAYS

▽ Total Q for two pipes



NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

FOXS LAKE DAM

ROCKAWAY TOWNSHIP, NEW JERSEY

REGIONAL VICINITY MAP

JANUARY 1980

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

ANDERSON-NICHOLS & CO., INC. CONCORD, N.H.

SCALE IN MILES

0 1/2 1

MAP BASED ON U.S.G.S. 7.5 MINUTE QUADRANGLE SHEET. DOVER, N.J., 1954. REVISED, 1970.

HEC-1 OUTPUT

OVERTOPPING ANALYSIS

FOXS LAKE DAM

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
 LAST MODIFICATION  26 FEB 79
**********
    1          A1  FOXS POND  DAM  OVERTOPPING ANALYSIS ### GUS SHARRY  ANDERSON-NICHOLS ###
    2          A2  NEW JERSEY DAM NUMBER 25-49   BOROUGH OF ROCKAWAY  MORRIS COUNTY
    3          A3   0.5 MULTIPLE OF PMF FROM 24-HOUR PMF
    4          P    165       0       10        0        0        0        0        0        0        0
    5          B1     5
    6          J      2       3        1
    7          J1   0.1     0.25      0.5
    8          K                     A1                                      1
    9          K1  DEVELOP INFLOW HYDROGRAPH
   10          M      1       2      1.2                              0.8                      1
   11          P             22.8     113      123.     132
   12          T                                                       1      0.1
   13          W2            0.56
   14          Y     -3
   15          K      1               A2                                      1
   16          K1  ROUTE INFLOW HYDROGRAPH THROUGH RESERVOIR
   17          Y                                        1        1
   18          Y1     1                                                      63     -1
   19          Y4 613.0    615.7    616.2    616.3    617.3    617.4    618.2    618.7    620.     621.
   20          Y5     0      138      198      217      558      763     1408     1997     4987     8603
   21          $S     0       63       97      104      106      121      123      137      145      170
   22          $S   190
   23          $E 606.9    613.0    615.7    616.2    616.3    617.3    617.4    618.2    618.7    620.
   24          $E   621.
   25          $$ 613.0
   26          $D 615.7
   27          $R   7.6       1    606.9        1    613.0    615.7
   28          $B   7.6       1    606.9        1    613.0    625.0
   29          K      1               A3                                      1        1
   30          K1 CHANNEL ROUTING  MOD PULS  REACH 1
   31          Y                                        1        1
   32          Y1     1                                                      -1
   33          Y6  0.05     0.04     0.05    550.0    562.0   1400.0    0.033
   34          Y7     0.     562.      32.     558.      64.     554.      96.     550.     111.     550.
   35          Y7  151.     554.     191.     558.     231.     562.
   36          K      1               A4                                      1        1
   37          K1 CHANNEL ROUTING  MOD PULS  FIRST CULVERT
   38          Y                                        1        1
   39          Y1     1                                                      -1
   40          Y6 0.016    0.014    0.016    548.0    560.0     35.0    0.033
   41          Y7     0.     560.      75.     557.5     150.     555.     150.     548.     154.     548.
   42          Y7   154.     555.     229.     557.5     304.     560.
   43          K      1               A5                                      1        1
   44          K1 CHANNEL ROUTING  MOD PULS  REACH 2
   45          Y                                        1        1
   46          Y1     1                                                      -1
   47          Y6 0.035    0.05     0.04     546.0    558.0    300.0    0.033
   48          Y7     0.     558.      315.    547.5     315.     546.5    320.     546.     325.     546.5
   49          Y7   325.    547.5     490.     553.     640.     558.
   50          K     99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	A1
ROUTE HYDROGRAPH TO	A2
ROUTE HYDROGRAPH TO	A3
ROUTE HYDROGRAPH TO	A4
ROUTE HYDROGRAPH TO	A5
END OF NETWORK	

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION  JULY 1978
 LAST MODIFICATION  26 FEB 79
**********

RUN  DATE= 79/12/07.
     TIME= 05.47.17.
```

PARK LAKES DAM OVERTOPPING ANALYSIS ### GUS SHARRY ANDERSON-NICHOLS ###
NEW JERSEY DAM NUMBER 25-49 BOROUGH OF ROCKAWAY MORRIS COUNTY
0.5 MULTIPLE OF PMF FROM 24-HOUR PMP

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
165	0	10	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 2 NRTIO= 3 LRTIO= 1

RTIOS= .10 .25 .50

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

DEVELOP INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	1.20	0.00	1.20	.80	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.80	113.00	123.00	132.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.10	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .56

RECESSION DATA
STRTQ= -3.00 QRCSN= 0.00 RTIOR= 1.00

UNIT HYDROGRAPH 19 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .56 VOL= 1.00

138.	455.	816.	898.	778.	554.	344.	229.	151.	98.
64.	42.	28.	19.	12.	8.	6.	3.	1.	

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.10	1	.02	0.00	.02	4.	1.01	13.50	83	.41	.40	.02	1699.
1.01	.20	2	.02	0.00	.02	4.	1.01	14.00	84	.41	.40	.02	1749.
1.01	.30	3	.02	0.00	.02	4.	1.01	14.10	85	.52	.50	.02	1795.
1.01	.40	4	.02	0.00	.02	4.	1.01	14.20	86	.52	.50	.02	1863.
1.01	.50	5	.02	0.00	.02	4.	1.01	14.30	87	.52	.50	.02	1961.
1.01	1.00	6	.02	0.00	.02	4.	1.01	14.40	88	.52	.50	.02	2063.
1.01	1.10	7	.02	0.00	.02	4.	1.01	14.50	89	.52	.50	.02	2149.
1.01	1.20	8	.02	0.00	.02	4.	1.01	15.00	90	.52	.50	.02	2210.
1.01	1.30	9	.02	0.00	.02	4.	1.01	15.10	91	.47	.45	.02	2242.
1.01	1.40	10	.02	0.00	.02	4.	1.01	15.20	92	.78	.77	.02	2289.
1.01	1.50	11	.02	0.00	.02	4.	1.01	15.30	93	1.41	1.39	.02	2497.
1.01	2.00	12	.02	0.00	.02	4.	1.01	15.40	94	3.52	3.51	.02	3300.
1.01	2.10	13	.02	0.00	.02	4.	1.01	15.50	95	1.02	1.00	.02	4680.
1.01	2.20	14	.02	0.00	.02	4.	1.01	16.00	96	.63	.61	.02	5998.
1.01	2.30	15	.02	0.00	.02	4.	1.01	16.10	97	.48	.46	.02	6303.
1.01	2.40	16	.02	0.00	.02	4.	1.01	16.20	98	.48	.46	.02	5758.
1.01	2.50	17	.02	0.00	.02	4.	1.01	16.30	99	.48	.46	.02	4791.
1.01	3.00	18	.02	0.00	.02	4.	1.01	16.40	100	.48	.46	.02	3881.
1.01	3.10	19	.02	0.00	.02	4.	1.01	16.50	101	.48	.46	.02	3294.
1.01	3.20	20	.02	0.00	.02	4.	1.01	17.00	102	.48	.46	.02	2905.
1.01	3.30	21	.02	0.00	.02	4.	1.01	17.10	103	.38	.36	.02	2633.
1.01	3.40	22	.02	0.00	.02	4.	1.01	17.20	104	.38	.36	.02	2418.
1.01	3.50	23	.02	0.00	.02	4.	1.01	17.30	105	.38	.36	.02	2224.
1.01	4.00	24	.02	0.00	.02	4.	1.01	17.40	106	.38	.36	.02	2059.
1.01	4.10	25	.02	0.00	.02	4.	1.01	17.50	107	.38	.36	.02	1932.
1.01	4.20	26	.02	0.00	.02	4.	1.01	18.00	108	.38	.36	.02	1844.
1.01	4.30	27	.02	0.00	.02	4.	1.01	18.10	109	.03	.01	.02	1741.
1.01	4.40	28	.02	0.00	.02	4.	1.01	18.20	110	.03	.01	.02	1544.
1.01	4.50	29	.02	0.00	.02	4.	1.01	18.30	111	.03	.01	.02	1230.
1.01	5.00	30	.02	0.00	.02	4.	1.01	18.40	112	.03	.01	.02	896.
1.01	5.10	31	.02	0.00	.02	4.	1.01	18.50	113	.03	.01	.02	613.
1.01	5.20	32	.02	0.00	.02	4.	1.01	19.00	114	.03	.01	.02	413.
1.01	5.30	33	.02	0.00	.02	4.	1.01	19.10	115	.03	.01	.02	290.
1.01	5.40	34	.02	0.00	.02	4.	1.01	19.20	116	.03	.01	.02	208.
1.01	5.50	35	.02	0.00	.02	4.	1.01	19.30	117	.03	.01	.02	153.
1.01	6.00	36	.02	0.00	.02	4.	1.01	19.40	118	.03	.01	.02	118.
1.01	6.10	37	.05	0.00	.05	4.	1.01	19.50	119	.03	.01	.02	95.
1.01	6.20	38	.05	0.00	.05	4.	1.01	20.00	120	.03	.01	.02	80.
1.01	6.30	39	.05	0.00	.05	4.	1.01	20.10	121	.03	.01	.02	70.
1.01	6.40	40	.05	0.00	.05	4.	1.01	20.20	122	.03	.01	.02	64.
1.01	6.50	41	.05	0.00	.05	4.	1.01	20.30	123	.03	.01	.02	59.
1.01	7.00	42	.05	0.00	.05	4.	1.01	20.40	124	.03	.01	.02	57.
1.01	7.10	43	.05	.01	.04	5.	1.01	20.50	125	.03	.01	.02	55.
1.01	7.20	44	.05	.03	.02	12.	1.01	21.00	126	.03	.01	.02	54.
1.01	7.30	45	.05	.03	.02	30.	1.01	21.10	127	.03	.01	.02	53.
1.01	7.40	46	.05	.03	.02	58.	1.01	21.20	128	.03	.01	.02	53.
1.01	7.50	47	.05	.03	.02	88.	1.01	21.30	129	.03	.01	.02	53.
1.01	8.00	48	.05	.03	.02	113.	1.01	21.40	130	.03	.01	.02	53.
1.01	8.10	49	.05	.03	.02	130.	1.01	21.50	131	.03	.01	.02	53.
1.01	8.20	50	.05	.03	.02	141.	1.01	22.00	132	.03	.01	.02	53.
1.01	8.30	51	.05	.03	.02	148.	1.01	22.10	133	.03	.01	.02	53.
1.01	8.40	52	.05	.03	.02	153.	1.01	22.20	134	.03	.01	.02	53.
1.01	8.50	53	.05	.03	.02	156.	1.01	22.30	135	.03	.01	.02	53.
1.01	9.00	54	.05	.03	.02	158.	1.01	22.40	136	.03	.01	.02	53.
1.01	9.10	55	.05	.03	.02	159.	1.01	22.50	137	.03	.01	.02	53.
1.01	9.20	56	.05	.03	.02	160.	1.01	23.00	138	.03	.01	.02	53.
1.01	9.30	57	.05	.03	.02	161.	1.01	23.10	139	.03	.01	.02	53.
1.01	9.40	58	.05	.03	.02	161.	1.01	23.20	140	.03	.01	.02	53.

1.01	9.50	59	.05	.03	.02	161.	1.01	23.30	141	.03	.01	.02	53.
1.01	10.00	60	.05	.03	.02	161.	1.01	23.40	142	.03	.01	.02	53.
1.01	10.10	61	.05	.03	.02	161.	1.01	23.50	143	.03	.01	.02	53.
1.01	10.20	62	.05	.03	.02	161.	1.02	0.00	144	.03	.01	.02	53.
1.01	10.30	63	.05	.03	.02	161.	1.02	.10	145	0.00	0.00	0.00	52.
1.01	10.40	64	.05	.03	.02	161.	1.02	.20	146	0.00	0.00	0.00	47.
1.01	10.50	65	.05	.03	.02	161.	1.02	.30	147	0.00	0.00	0.00	38.
1.01	11.00	66	.05	.03	.02	161.	1.02	.40	148	0.00	0.00	0.00	29.
1.01	11.10	67	.05	.03	.02	161.	1.02	.50	149	0.00	0.00	0.00	20.
1.01	11.20	68	.05	.03	.02	161.	1.02	1.00	150	0.00	0.00	0.00	14.
1.01	11.30	69	.05	.03	.02	161.	1.02	1.10	151	0.00	0.00	0.00	11.
1.01	11.40	70	.05	.03	.02	161.	1.02	1.20	152	0.00	0.00	0.00	8.
1.01	11.50	71	.05	.03	.02	161.	1.02	1.30	153	0.00	0.00	0.00	7.
1.01	12.00	72	.05	.03	.02	161.	1.02	1.40	154	0.00	0.00	0.00	6.
1.01	12.10	73	.34	.33	.02	202.	1.02	1.50	155	0.00	0.00	0.00	5.
1.01	12.20	74	.34	.33	.02	335.	1.02	2.00	156	0.00	0.00	0.00	4.
1.01	12.30	75	.34	.33	.02	574.	1.02	2.10	157	0.00	0.00	0.00	4.
1.01	12.40	76	.34	.33	.02	837.	1.02	2.20	158	0.00	0.00	0.00	4.
1.01	12.50	77	.34	.33	.02	1065.	1.02	2.30	159	0.00	0.00	0.00	4.
1.01	13.00	78	.34	.33	.02	1227.	1.02	2.40	160	0.00	0.00	0.00	4.
1.01	13.10	79	.41	.40	.02	1338.	1.02	2.50	161	0.00	0.00	0.00	4.
1.01	13.20	80	.41	.40	.02	1436.	1.02	3.00	162	0.00	0.00	0.00	4.
1.01	13.30	81	.41	.40	.02	1536.	1.02	3.10	163	0.00	0.00	0.00	4.
1.01	13.40	82	.41	.40	.02	1627.	1.02	3.20	164	0.00	0.00	0.00	4.
							1.02	3.30	165	0.00	0.00	0.00	4.
									SUM	24.08	21.39	2.69	99940.
										(612.)(	543.)(	68.)(	2829.99)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6303.	2504.	693.	606.	99924.
CMS	178.	71.	20.	17.	2830.
INCHES		19.41	21.50	21.52	21.52
MM		493.06	546.13	546.53	546.53
AC-FT		1242.	1375.	1376.	1376.
THOUS CU M		1532.	1697.	1698.	1698.

HYDROGRAPH AT STA A1 FOR PLAN 1, RTIC 3

2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	6.	15.	29.	44.	56.	65.	70.
74.	76.	78.	79.	80.	80.	80.	80.	81.	81.
81.	81.	81.	81.	81.	81.	81.	81.	81.	81.
81.	81.	101.	168.	287.	419.	533.	614.	669.	718.
768.	813.	849.	875.	898.	932.	981.	1032.	1075.	1105.
1121.	1145.	1249.	1650.	2340.	2999.	3151.	2879.	2395.	1940.
1647.	1452.	1316.	1209.	1112.	1030.	966.	922.	871.	772.
615.	448.	306.	207.	145.	104.	77.	59.	47.	40.
35.	32.	30.	20.	27.	27.	27.	27.	27.	27.
27.	27.	27.	27.	27.	27.	27.	27.	27.	27.
27.	27.	27.	27.	26.	23.	19.	14.	10.	7.
5.	4.	3.	3.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.					

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3151.	1252.	347.	303.	49962.
CMS	89.	35.	10.	9.	1415.
INCHES		9.71	10.75	10.76	10.76

	PM	246.53	273.07	273.26	273.26
	AC-FT	621.	688.	688.	688.
	THOUS CU M	766.	848.	849.	849.

PLAN 2 SAME AS PLAN 1

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HYDROGRAPH ROUTING

ROUTE INFLOW HYDROGRAPH THROUGH RESERVOIR

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A2	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	63.	-1

STAGE	613.00	615.70	616.20	616.30	617.30	617.40	618.20	618.70	620.00	621.00
FLOW	0.00	138.00	198.00	217.00	558.00	763.00	1408.00	1997.00	4987.00	8603.00
CAPACITY=	0.	63.	97.	104.	106.	121.	123.	137.	145.	170.
	190.									
ELEVATION=	607.	613.	616.	616.	616.	617.	617.	618.	619.	620.
	621.									

CREL	SPWID	COOW	EXPW	FLEVL	COOL	CAREA	EXPL
613.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
61547	0.0	0.0	0.

STATION A2, PLAN 2, RATIO 3

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	3.	5.	8.	10.	14.
17.	20.	23.	26.	29.	32.	34.	37.	39.	41.
44.	46.	48.	49.	51.	53.	54.	56.	57.	58.
60.	61.	62.	66.	75.	90.	111.	136.	191.	293.
415.	517.	694.	804.	844.	878.	916.	959.	1004.	1046.
1078.	1104.	1148.	1293.	1720.	2483.	3018.	3015.	2674.	2217.
1876.	1656.	1473.	1353.	1260.	1169.	1086.	1018.	959.	893.
797.	602.	511.	442.	370.	304.	246.	208.	190.	174.
158.	145.	135.	129.	124.	118.	113.	109.	104.	100.
96.	92.	89.	85.	82.	79.	76.	74.	71.	69.
66.	64.	62.	60.	58.	57.	55.	53.	50.	48.
46.	44.	41.	39.	37.	35.	34.	32.	30.	29.
27.	26.	25.	23.	22.					

STORAGE

63.	63.	63.	63.	63.	63.	63.	63.	63.	63.
63.	63.	63.	63.	63.	63.	63.	63.	63.	63.

63.	63.	63.	63.	63.	63.	63.	63.	63.	63.
63.	63.	63.	63.	63.	63.	63.	63.	63.	63.
63.	63.	63.	63.	64.	64.	64.	65.	66.	66.
67.	68.	69.	69.	70.	71.	71.	72.	73.	73.
74.	74.	75.	75.	76.	76.	76.	77.	77.	77.
78.	78.	78.	79.	81.	85.	90.	97.	103.	109.
115.	119.	122.	124.	125.	125.	126.	127.	128.	129.
130.	130.	131.	135.	141.	149.	154.	154.	151.	147.
143.	140.	138.	136.	134.	132.	130.	129.	127.	126.
124.	121.	119.	116.	113.	110.	107.	105.	103.	101.
99.	98.	96.	95.	93.	92.	91.	90.	89.	88.
87.	86.	85.	84.	83.	83.	82.	81.	81.	80.
79.	79.	78.	78.	77.	77.	76.	76.	75.	75.
74.	74.	73.	73.	72.	72.	71.	71.	70.	70.
70.	69.	69.	69.	68.					

STAGE

613.0	613.0	613.0	613.0	613.0	613.0	613.0	613.0	613.0	613.0
613.0	613.0	613.0	613.0	613.0	613.0	613.0	613.0	613.0	613.0
613.0	613.0	613.0	613.0	613.0	613.0	613.0	613.0	613.0	613.0
613.0	613.0	613.0	613.0	613.0	613.0	613.0	613.0	613.0	613.0
613.0	613.0	613.0	613.0	613.0	613.1	613.1	613.1	613.2	613.3
613.3	613.4	613.5	613.5	613.6	613.6	613.7	613.7	613.8	613.8
613.9	613.9	613.9	614.0	614.0	614.0	614.1	614.1	614.1	614.1
614.2	614.2	614.2	614.3	614.5	614.8	615.2	615.7	616.1	616.5
616.9	617.2	617.4	617.5	617.5	617.5	617.6	617.6	617.7	617.8
617.8	617.8	617.9	618.1	618.5	618.9	619.1	619.1	619.0	618.8
618.6	618.4	618.3	618.1	618.0	617.9	617.8	617.7	617.6	617.6
617.4	617.3	617.2	617.0	616.7	616.6	616.4	616.3	616.1	616.0
615.9	615.8	615.6	615.5	615.4	615.3	615.2	615.1	615.0	615.0
614.9	614.8	614.7	614.7	614.6	614.5	614.5	614.4	614.4	614.3
614.3	614.3	614.2	614.2	614.1	614.1	614.1	614.0	614.0	613.9
613.9	613.9	613.8	613.8	613.7	613.7	613.7	613.6	613.6	613.6
613.5	613.5	613.5	613.5	613.4					

PEAK OUTFLOW IS 3018. AT TIME 16.17 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3018.	1211.	344.	300.	49569.
CMS	85.	34.	10.	9.	1404.
INCHES		9.39	10.67	10.67	10.67
MM		238.42	271.03	271.11	271.11
AC-FT		600.	683.	683.	683.
THOUS CU M		741.	842.	842.	842.

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HYDROGRAPH ROUTING

CHANNEL ROUTING MOD PULS REACH 1

ICTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A3	1	0	0	0	1	1	0	0

ALL PLANS HAVE SAME

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0500	.0400	.0500	550.0	562.0	1400.	.03300

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

	0.00	562.00	32.00	558.00	64.00	554.00	96.00	550.00	111.00	550.00
	151.00	554.00	191.00	558.00	231.00	562.00				
STORAGE	0.00	.42	1.07	1.95	3.06	4.41	5.98	7.79	9.82	12.09
	14.58	17.31	20.27	23.46	26.88	30.53	34.41	38.52	42.86	47.44
OUTFLOW	0.00	55.25	206.87	472.14	871.11	1423.00	2146.02	3200.49	4539.80	6107.99
	7916.24	9975.00	12294.35	14884.18	17754.24	20914.13	24373.33	28141.19	32226.97	36639.80
STAGE	550.00	550.63	551.26	551.89	552.53	553.16	553.79	554.42	555.05	555.68
	556.32	556.95	557.58	558.21	558.84	559.47	560.11	560.74	561.37	562.00
FLOW	0.00	55.25	206.87	472.14	871.11	1423.00	2146.02	3200.49	4539.80	6107.99
	7916.24	9975.00	12294.35	14884.18	17754.24	20914.13	24373.33	28141.19	32226.97	36639.80

STATION A3, PLAN 2, RTIO 3

OUTFLOW

0.	0.	0.	0.	0.	0.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	3.	4.	6.	9.	12.
15.	18.	21.	24.	27.	30.	33.	35.	38.	40.
42.	45.	46.	48.	50.	52.	53.	55.	57.	58.
59.	60.	62.	65.	72.	85.	104.	128.	172.	263.
396.	495.	652.	790.	838.	870.	909.	951.	997.	1039.
1073.	1100.	1139.	1260.	1630.	2357.	2987.	3035.	2730.	2274.
1922.	1685.	1502.	1369.	1277.	1185.	1101.	1029.	969.	905.
818.	649.	517.	460.	387.	319.	259.	216.	194.	179.
163.	149.	138.	131.	125.	120.	115.	110.	106.	101.

97.	93.	90.	86.	83.	80.	77.	74.	72.	69.
67.	65.	63.	61.	59.	57.	55.	54.	52.	49.
47.	45.	43.	40.	38.	36.	35.	33.	31.	30.
28.	27.	25.	24.	23.					

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	1.	1.	1.	1.
2.	2.	2.	3.	3.	3.	3.	3.	3.	3.
4.	4.	4.	4.	5.	6.	7.	8.	7.	6.
5.	5.	5.	4.	4.	4.	4.	3.	3.	3.
3.	2.	2.	2.	2.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.					

STAGE

550.0	550.0	550.0	550.0	550.0	550.0	550.0	550.0	550.0	550.0
550.0	550.0	550.0	550.0	550.0	550.0	550.0	550.0	550.0	550.0
550.0	550.0	550.0	550.0	550.0	550.0	550.0	550.0	550.0	550.0
550.0	550.0	550.0	550.0	550.0	550.0	550.0	550.0	550.0	550.0
550.0	550.0	550.0	550.0	550.0	550.0	550.0	550.1	550.1	550.1
550.2	550.2	550.2	550.3	550.3	550.3	550.4	550.4	550.4	550.5
550.5	550.5	550.5	550.6	550.6	550.6	550.6	550.6	550.6	550.6
550.6	550.7	550.7	550.7	550.7	550.8	550.8	550.9	551.1	551.4
551.7	551.9	552.2	552.4	552.5	552.5	552.6	552.6	552.7	552.7
552.8	552.8	552.8	553.0	553.3	553.9	554.3	554.3	554.1	553.9
553.6	553.4	553.2	553.1	553.0	552.9	552.8	552.7	552.6	552.6
552.4	552.2	552.0	551.9	551.7	551.5	551.4	551.3	551.2	551.1
551.1	551.0	551.0	550.9	550.9	550.9	550.9	550.9	550.8	550.8
550.8	550.8	550.8	550.8	550.7	550.7	550.7	550.7	550.7	550.7
550.7	550.7	550.7	550.7	550.6	550.6	550.6	550.6	550.6	550.6
550.5	550.5	550.5	550.5	550.4	550.4	550.4	550.4	550.4	550.3
550.3	550.3	550.3	550.3	550.3					

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3035.	1211.	344.	300.	49556.
CMS	86.	34.	10.	9.	1403.
INCHES		9.38	10.67	10.67	10.67
MM		238.35	270.96	271.05	271.05
AC-FT		600.	682.	683.	683.
THOUS CU M		740.	842.	842.	842.

MAXIMUM STORAGE = 8.

MAXIMUM STAGE IS 554.3

HYDROGRAPH ROUTING

CHANNEL ROUTING MOD PULS FIRST CULVERT

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
AA	1	0	0	0	1	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-14	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0160	.0140	.0160	548.0	560.0	35.	.03300

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

0.00 560.00 75.00 557.50 150.00 555.00 150.00 548.00 154.00 548.00
154.00 555.00 229.00 557.50 304.00 560.00

STORAGE	0.00	.00	.00	.01	.01	.01	.01	.01	.02	.02
	.02	.02	.03	.06	.11	.18	.26	.37	.50	.64
OUTFLOW	0.00	29.94	82.36	143.88	210.24	279.52	350.70	423.19	496.62	570.75
	645.41	720.50	904.10	1480.03	2702.42	4780.43	7899.46	12229.34	17928.60	25146.96
STAGE	548.00	548.63	549.26	549.89	550.53	551.16	551.79	552.42	553.05	553.68
	554.32	554.95	555.58	556.21	556.84	557.47	558.11	558.74	559.37	560.00
FLOW	0.00	29.94	82.36	143.88	210.24	279.52	350.70	423.19	496.62	570.75
	645.41	720.50	904.10	1480.03	2702.42	4780.43	7899.46	12229.34	17928.60	25146.96

STATION A4, PLAN 2, RATIO 3

0.	0.	0.	0.	0.	0.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	3.	4.	6.	9.	12.
15.	18.	21.	24.	27.	30.	33.	35.	38.	40.
42.	45.	46.	48.	50.	52.	53.	55.	57.	58.
59.	60.	62.	65.	72.	85.	104.	128.	171.	263.
386.	495.	652.	790.	838.	870.	909.	951.	997.	1038.
1073.	1100.	1139.	1259.	1629.	2355.	2986.	3035.	2731.	2275.
1922.	1687.	1502.	1370.	1277.	1186.	1100.	1030.	969.	906.
818.	650.	517.	461.	387.	320.	259.	217.	194.	180.
162.	150.	137.	132.	125.	121.	114.	111.	105.	102.
97.	94.	89.	87.	83.	81.	77.	75.	71.	70.
66.	65.	62.	61.	58.	58.	55.	54.	51.	50.
47.	45.	42.	41.	38.	37.	34.	33.	31.	30.
28.	27.	25.	24.	22.					

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.					

STAGE

548.0	548.0	548.0	548.0	548.0	548.0	548.0	548.0	548.0	548.0
548.0	548.0	548.0	548.0	548.0	548.0	548.0	548.0	548.0	548.0
548.0	548.0	548.0	548.0	548.0	548.0	548.0	548.0	548.0	548.0
548.0	548.0	548.0	548.0	548.0	548.0	548.0	548.0	548.0	548.0
548.0	548.0	548.0	548.0	548.0	548.1	548.1	548.1	548.2	548.3
548.3	548.4	548.4	548.5	548.6	548.6	548.7	548.7	548.7	548.8
548.8	548.8	548.8	548.9	548.9	548.9	548.9	548.9	549.0	549.0
549.0	549.0	549.0	549.1	549.1	549.3	549.5	549.7	550.2	551.0
552.1	553.0	554.4	555.2	555.4	555.5	555.6	555.6	555.7	555.7
555.8	555.8	555.8	556.0	556.3	556.7	556.9	556.9	556.9	556.6
556.4	556.3	556.2	556.1	556.0	555.9	555.8	555.7	555.6	555.6
555.3	554.4	553.2	552.7	552.1	551.5	551.0	550.6	550.4	550.2
550.1	549.9	549.8	549.8	549.7	549.7	549.6	549.6	549.5	549.5
549.4	549.4	549.3	549.3	549.3	549.2	549.2	549.2	549.1	549.1
549.1	549.1	549.0	549.0	549.0	549.0	548.9	548.9	548.9	548.9
548.8	548.8	548.8	548.8	548.7	548.7	548.7	548.7	548.6	548.6
548.6	548.6	548.5	548.5	548.5					

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3035.	1211.	344.	300.	49556.
CMS	86.	34.	10.	9.	1403.
INCHES		9.38	10.67	10.67	10.67
MM		238.35	270.96	271.04	271.04
AC-FT		600.	682.	683.	683.
THOUS CU M		740.	842.	842.	842.

MAXIMUM STORAGE = 0.

MAXIMUM STAGE IS 556.9

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HYDROGRAPH ROUTING

CHANNEL ROUTING MOD PULS REACH 2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
AS	1	0	0	0	1	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELMVT	ELMAX	RLNTH	SEL
.0350	.0500	.0400	546.0	558.0	300.	.03300

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

	0.00	558.00	315.00	547.50	315.00	546.50	320.00	546.00	325.00	546.50
	325.00	547.50	490.00	553.00	640.00	558.00				
STORAGE	0.00	.03	.07	.15	.37	.77	1.33	2.05	2.94	3.99
	5.21	6.59	8.14	9.85	11.73	13.77	15.98	18.35	20.89	23.59
OUTFLOW	0.00	10.65	50.18	121.04	335.10	810.57	1640.13	2904.82	4678.45	7029.67
	10023.21	13720.63	18180.87	23460.67	29614.84	36696.53	44757.38	53847.70	64016.60	75312.10
STAGE	546.00	546.63	547.26	547.89	548.53	549.16	549.79	550.42	551.05	551.68
	552.32	552.95	553.58	554.21	554.84	555.47	556.11	556.74	557.37	558.00
FLOW	0.00	10.65	50.18	121.04	335.10	810.57	1640.13	2904.82	4678.45	7029.67
	10023.21	13720.63	18180.87	23460.67	29614.84	36696.53	44757.38	53847.70	64016.60	75312.10

STATION A5, PLAN 2, RTIO 3

OUTFLOW

0.	0.	0.	0.	0.	0.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	3.	4.	6.	8.	11.
15.	18.	21.	24.	27.	30.	33.	35.	38.	40.
42.	44.	46.	48.	50.	52.	53.	55.	56.	58.
59.	60.	62.	65.	71.	84.	102.	126.	167.	254.
377.	490.	639.	785.	837.	868.	907.	948.	994.	1037.
1071.	1099.	1136.	1251.	1603.	2320.	2967.	3048.	2742.	2301.
1927.	1700.	1507.	1378.	1279.	1193.	1102.	1035.	971.	911.
822.	664.	520.	465.	392.	324.	264.	218.	196.	180.
164.	150.	139.	131.	126.	120.	115.	111.	106.	102.
98.	94.	90.	87.	83.	80.	77.	75.	72.	70.
67.	65.	63.	61.	59.	57.	55.	54.	52.	49.
47.	45.	43.	41.	39.	37.	35.	33.	31.	30.
28.	27.	25.	24.	23.					

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	2.	2.	2.	2.	2.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.					

STAGE

546.0	546.0	546.0	546.0	546.0	546.0	546.0	546.0	546.0	546.0
546.0	546.0	546.1	546.1	546.1	546.1	546.1	546.1	546.1	546.1
546.1	546.1	546.1	546.1	546.1	546.1	546.1	546.1	546.1	546.1
546.1	546.1	546.1	546.1	546.1	546.1	546.1	546.1	546.1	546.1
546.1	546.1	546.1	546.1	546.1	546.2	546.2	546.3	546.5	546.6
546.7	546.7	546.8	546.8	546.9	546.9	547.0	547.0	547.1	547.1
547.1	547.2	547.2	547.2	547.3	547.3	547.3	547.3	547.3	547.3
547.3	547.4	547.4	547.4	547.5	547.6	547.7	547.9	548.0	548.3
548.6	548.7	548.9	549.1	549.2	549.2	549.2	549.3	549.3	549.3
549.4	549.4	549.4	549.5	549.8	550.1	550.4	550.5	550.3	550.1
549.9	549.8	549.7	549.6	549.5	549.4	549.4	549.3	549.3	549.2
549.2	549.0	548.8	548.7	548.6	548.5	548.3	548.2	548.1	548.1
548.0	548.0	547.9	547.9	547.9	547.9	547.8	547.8	547.8	547.7
547.7	547.7	547.6	547.6	547.6	547.5	547.5	547.5	547.5	547.4
547.4	547.4	547.4	547.4	547.3	547.3	547.3	547.3	547.3	547.3

547.2 547.2 547.1 547.1 547.1 547.0 547.0 547.0 547.0 546.9
546.9 546.9 546.9 546.8 546.8

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3048.	1210.	344.	300.	49553.
CMS	86.	34.	10.	9.	1403.
INCHES		9.38	10.67	10.67	10.67
MM		238.32	270.95	271.03	271.03
AC-FT		600.	682.	683.	683.
THOUS CU M		740.	842.	842.	842.

MAXIMUM STORAGE = 2.

MAXIMUM STAGE IS 550.5

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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .10	RATIO 2 .25	RATIO 3 .50
HYDROGRAPH AT	A1	1.20 (3.11)	1	630. (17.85)	1576. (44.62)	3151. (89.24)
			2	630. (17.85)	1576. (44.62)	3151. (89.24)
ROUTED TO	A2	1.20 (3.11)	1	1103. (31.25)	1242. (35.18)	2874. (81.38)
			2	418. (11.82)	1403. (39.73)	3018. (85.46)
ROUTED TO	A3	1.20 (3.11)	1	1084. (30.68)	1242. (35.18)	2885. (81.71)
			2	418. (11.84)	1396. (39.54)	3035. (85.93)
ROUTED TO	A4	1.20 (3.11)	1	1083. (30.67)	1243. (35.19)	2886. (81.72)
			2	418. (11.84)	1396. (39.53)	3035. (85.95)
ROUTED TO	A5	1.20 (3.11)	1	1075. (30.45)	1242. (35.18)	2884. (81.67)
			2	417. (11.82)	1394. (39.46)	3048. (86.31)

* NOTE: ONLY PLAN 2 APPLIES.

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	613.00	613.00	615.70
STORAGE	63.	63.	97.
OUTFLOW	0.	0.	138.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	616.41	.71	108.	1103.	1.00	16.83	15.83
.25	616.15	.45	103.	1242.	.96	16.50	13.83
.50	617.79	2.09	130.	2874.	3.10	16.33	13.17

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	613.00	613.00	615.70
STORAGE	63.	63.	97.
OUTFLOW	0.	0.	138.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	616.89	1.19	115.	418.	3.50	16.67	0.00
.25	618.19	2.49	137.	1503.	6.17	16.33	0.00
.50	619.14	3.44	154.	3018.	7.33	16.17	0.00

PLAN 1 * STATION A3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	1004.	552.8	16.83
.25	1242.	553.0	16.50
.50	2885.	554.2	16.33

PLAN 2 STATION A3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	418.	551.8	16.67
.25	1396.	553.1	16.33
.50	3035.	554.3	16.33

PLAN 1 * STATION A4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	1003.	555.8	16.83
.25	1243.	556.0	16.50

*NOTE: ONLY PLAN 2 APPLIES.

.50	2886.	556.9	16.33

PLAN 2 STATION A4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	418.	552.4	16.67
.25	1396.	556.1	16.33
.50	3035.	556.9	16.33

PLAN 1* STATION A5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	1075.	549.4	16.83
.25	1242.	549.5	16.50
.50	2884.	550.4	16.33

PLAN 2 STATION A5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	417.	548.6	16.67
.25	1394.	549.6	16.33
.50	3048.	550.5	16.33

*NOTE: ONLY PLAN 2 APPLIES.

APPENDIX 5

REFERENCES

FOXS LAKE DAM

AD-A087 540 NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON F/G 13/13
NATIONAL DAM SAFETY PROGRAM. FOXS LAKE DAM (NJ00342), PASSAIC R--ETC(U)
JAN 80 W A GUINAN DACW61-79-C-0011
UNCLASSIFIED NL

2 OF 2
AD A087 540

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APPENDIX 5

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